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PART I

Bioventing Pilot Test Work Plan for the Bulk Fuel Storage Area Site McGuire AFB, New Jersey

PART II

Draft Interim Pilot Test Results Report for the Bulk Fuel Storage Area Site McGuire AFB, New Jersey

Prepared For

Air Force Center for Environmental Excellence
Brooks AFB, Texas

and

438th Civil Engineering Squadron
Environmental Management Branch
McGuire AFB, New Jersey

ES ENGINEERING-SCIENCE

ES
Engineering-Science, Inc.
1700 BROADWAY, SUITE 900
DENVER, COLORADO 80290

December 1992

AQ M01-03-0729

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PART I

BIOVENTING PILOT TEST WORK PLAN

for the

BULK FUEL STORAGE AREA SITE

MCGUIRE AFB, NEW JERSEY

Prepared for:

Air Force Center for Environmental Excellence

Brooks AFB, Texas

and

438th Civil Engineering Squadron and

Environmental Management Branch

McGuire AFB, New Jersey

Draft: September 1992

Final: December 1992

Prepared by:

Engineering-Science, Inc.
1700 Broadway, Suite 900
Denver, Colorado 80290

A7-16-13

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PART I - BIOVENTING PILOT TEST WORK PLAN FOR BULK FUEL STORAGE AREA SITE MCGUIRE AFB, NEW JERSEY

FIGURES

BIOVENTING TEST WORK PLAN FOR THE

BULK FUEL STORAGE AREA SITE

MCGUIRE AFB, NEW JERSEY

1.0 INTRODUCTION

This test work plan presents the scope of an *in situ* bioventing pilot test for treatment of fuel contaminated soils within the Bulk Fuel Storage Area (BFSA) at McGuire Air Force Base (AFB), New Jersey. The pilot tests have three primary objectives: 1) to assess the potential for supplying oxygen throughout the contaminated soil depth, 2) to determine the rate at which indigenous microorganisms will degrade fuel when stimulated by oxygen rich soil gas, and 3) to evaluate the potential for sustaining these rates of biodegradation until fuel contamination is remediated below regulatory standards.

If bioventing proves to be feasible at this site, pilot test data could be used to design a full-scale remediation system and to estimate the time required for site cleanup. An added benefit of the pilot testing is that a significant amount of the fuel contamination should be biodegraded during the one year pilot test since the testing will take place within the most contaminated soils on the site.

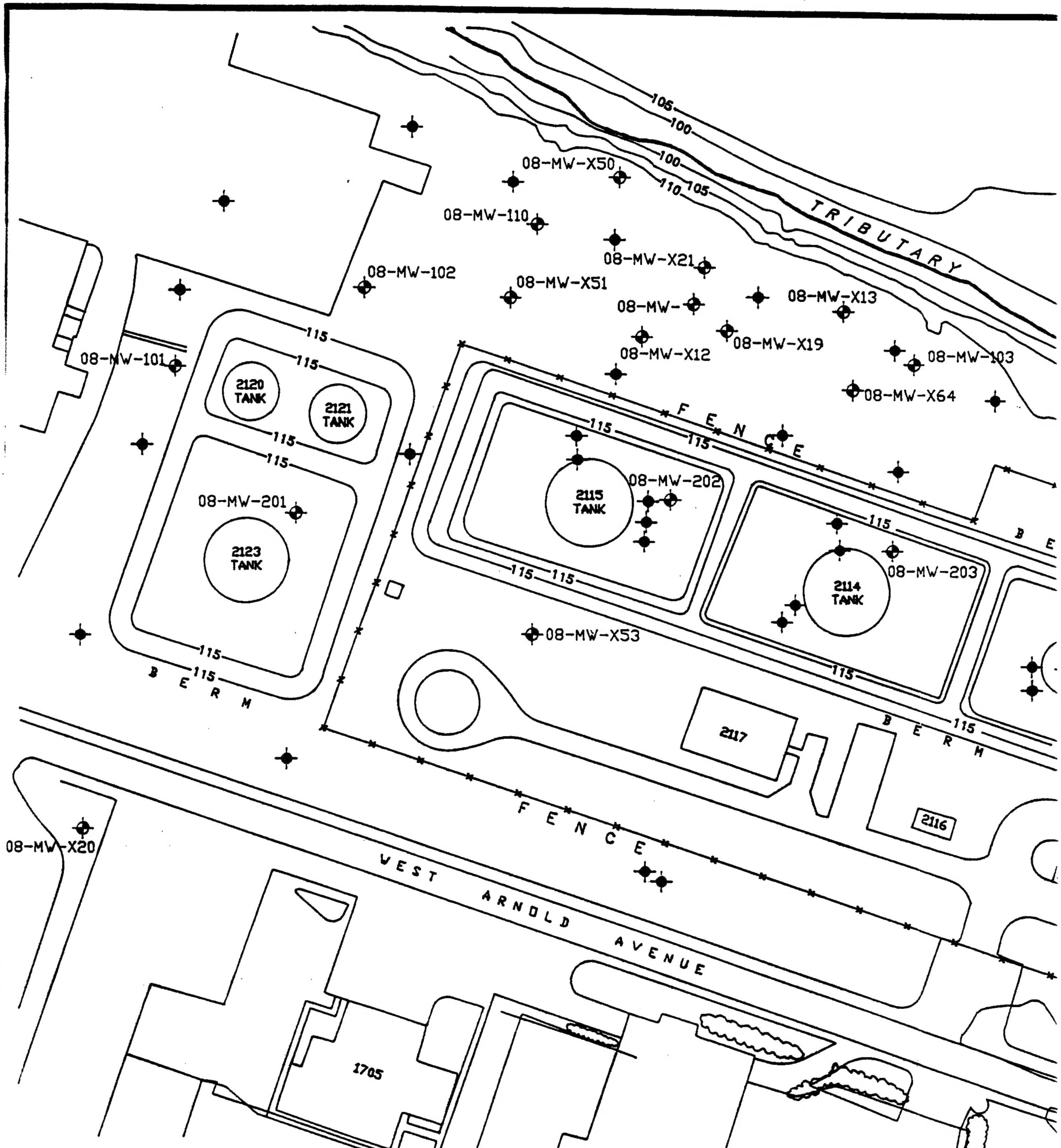
This test will involve injection at one vent well with a 40 scfm blower producing a radius of influence of approximately 40 feet. *In situ* rates of fuel biodegradation will be determined for individual soil vapor monitoring points.

Additional background information on the development and recent success of the bioventing technology is found in the attached document entitled "Test Plan and Technical Protocol For A Field Treatability Test For Bioventing." This protocol document will also serve as the primary reference for pilot test well designs and detailed procedures which will be used during the test.

2.0 SITE DESCRIPTION

2.1 Site Location and History

The BFSA at McGuire AFB is located in the central portion of the base. It is flanked by the base heating plant on the west, McGuire Boulevard on the east, West Arnold Avenue on the south and by a small tributary to the South Run on the north. The BFSA is in a fenced area with a total of 8 above ground storage tanks (Figure 2.1) used for the storage of JP-4 jet turbine fuel and No. 2 heating oil.



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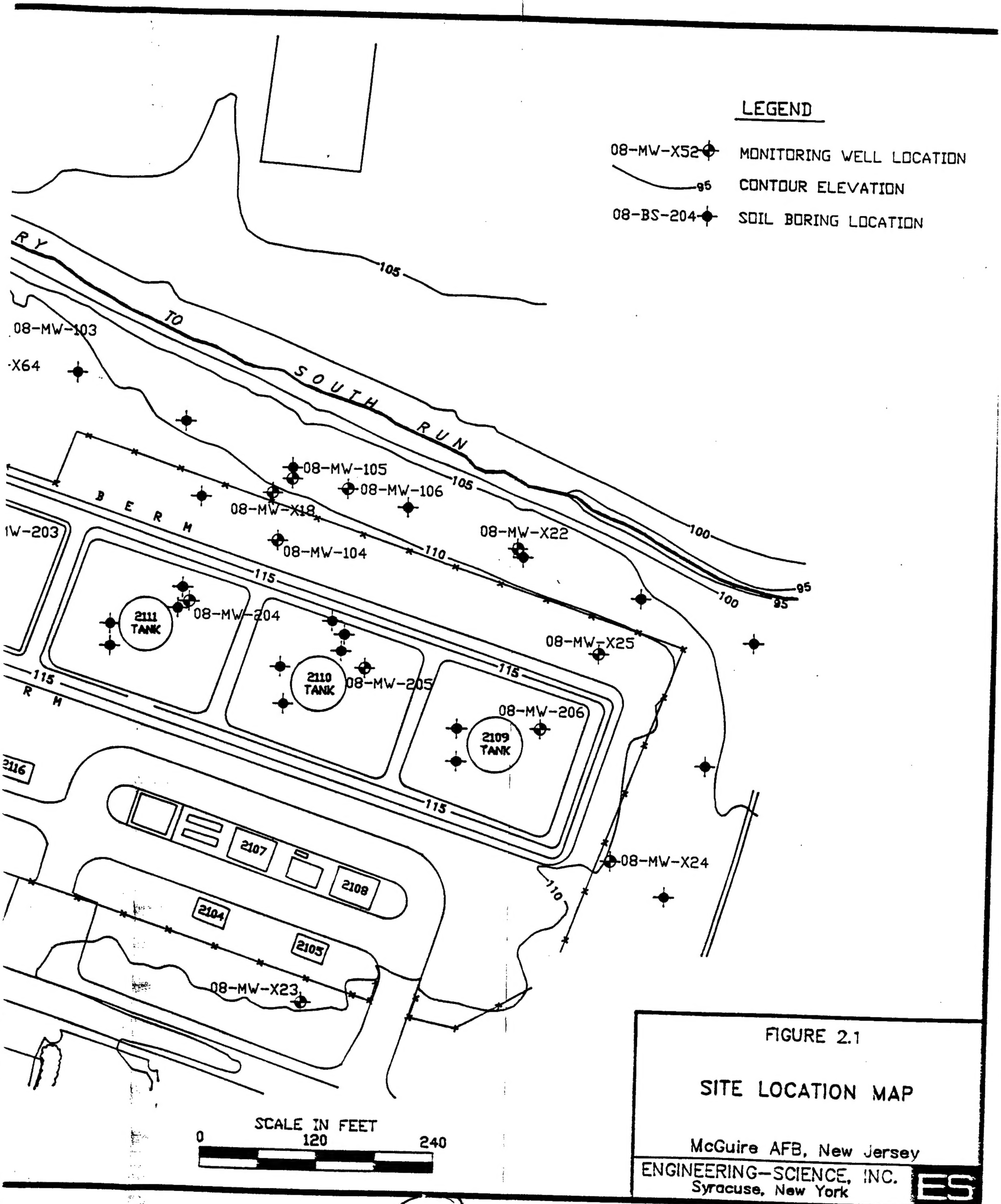

FIGURE 2.1

SITE LOCATION MAP

McGuire AFB, New Jersey

ENGINEERING-SCIENCE, INC.
Syracuse, New York

ES

2

In 1984, a leak in a former transfer line occurred, releasing an unknown amount of JP-4 to the surface in the northeastern corner of the BFSA. Subsequent site investigations indicated petroleum contaminated soils and groundwater in the vicinity of the spill. Ten on-site monitoring wells were sampled as part of the investigations. The wells located between the tank farm and the South Run tributary contained free phase petroleum product or dissolved petroleum constituents that could be associated with the spill. Measurements taken over the last eight years have indicated free product with thicknesses ranging from a visible sheen to approximately 6 feet.

2.2 Site Geology

Because the bioventing technology is applied to the unsaturated soils, this section will primarily address soils above the shallow aquifer. Based on boring logs of previous work, the unsaturated zone at the site consists of Pleistocene marine sand and silt. Ground water is encountered within the sand and silt in the release area at a depth of approximately 10 to 12 feet. Groundwater flows generally north-northwest toward a surface drainage stream approximately 100 to 150 feet from the release area.

Due to the relatively homogeneous nature of the sand and silt deposits, the permeability of soils to air flow should remain relatively constant across the site. Effective bioventing on this site is likely. ES has completed successful bioventing projects within similar geological deposits and we are confident that oxygen can be distributed in these soils. Soil vapor monitoring points (VMP's) will be positioned at three locations in and adjacent to the release area. At each of the locations, two 1/2" dia. VMP's will be installed as a cluster at two depths to study the subsurface oxygen distribution pattern prior to and during the pilot test.

2.3 Site Contaminants

The primary contaminants on this site are JP-4 fuel residuals which have migrated to a depth of approximately 10 feet where the maximum depth to groundwater is encountered. Free product with thickness up to 6 feet has been observed in monitoring wells on the site immediately north of the BFSA.

Hydrocarbon contamination in the form of BTEX and heavier components were detected in the soils at concentrations up to 3,000 mg/kg. Chlorinated compounds were also detected in soils at the site at concentrations of less than 100 μg/kg. Due to the short duration of the initial air permeability and in-situ respiration tests at the BFSA, little or no change in contaminant levels should occur.

3.0 SITE SPECIFIC ACTIVITIES

3.1 Introduction

The purpose of this section is to describe the proposed location of one vent well and three vapor monitoring points at the BFSA. Soil sampling procedures and the blower configuration that will be used to inject air (oxygen) into contaminated soils are also discussed in this section. Pilot test activities will be confined to unsaturated soils remediation; no dewatering will take place during the pilot tests. Existing

monitoring wells will not be used as primary air injection or extraction wells. However, monitoring wells which have a portion of their screened interval above the water table may be used as vapor monitoring points or to measure the composition of background soil gas.

3.2 Well Siting and Construction

A general description of criteria for siting the central venting well and the associated vapor monitoring points are included in the attached protocol. Figure 3.1 illustrates the proposed location of the central vent well and monitoring points at the BFSA. These locations were selected based on available analytical data and boring logs. These data show elevated hydrocarbon contamination extending from near the surface to the groundwater table near monitoring well MW-110 and soil boring BS-101. This area is expected to have a high average TPH concentration. Soils in this area are expected to be oxygen depleted (< 2%) and increased biological activity should be stimulated by oxygen-rich soil gas ventilation during pilot-scale operations. The final location of this well may vary slightly from the proposed location if significant fuel contamination is not observed in the boring for the central vent well.

Due to the relatively shallow depth of contamination at this site and the potential for moderate permeability soils, the radius of venting influence around the central air injection well is expected to approach 40 feet. Three vapor monitoring points will be located within a 40-foot radius of the central vent well. A background well will also be installed on the opposite side of the tributary to the South Run adjacent to the bioventing test area (Figure 3.2). The background well will be used to measure background levels of oxygen and carbon dioxide and to determine if natural carbon sources are contributing to oxygen uptake during the *in situ* respiration test. Additional details on the *in situ* respiration test are found in Section 5.7 of the attached protocol document.

The vent well will be constructed of 4-inch ID Schedule 40 PVC, with a ten foot interval of 0.04 slotted screen set between 5 and 15 feet below ground surface (the deepest seasonal groundwater elevation). Flush-threaded PVC casing and screen will be used with no organic solvents or glues. The filter pack will be clean, well-rounded silica sand with a 6-9 grain size and will be placed in the annular space of the screened interval. A 3-foot layer of bentonite will be placed directly over the filter pack. The first foot of bentonite will consist of bentonite pellets hydrated in place with potable water. This layer of pellets will prevent the addition of bentonite slurry from saturating the filter pack. The remaining two feet of bentonite will be fully hydrated and mixed above ground and the slurry tremied into the annular space to produce an air tight seal above the screened interval. A complete seal is critical to prevent injected air from short-circuiting to the surface during the bioventing test. Figure 3.3 illustrates the proposed central vent well construction for this site.

A typical multi-depth vapor monitoring point installation for this site is shown in Figure 3.4. Because of the rather shallow depth to groundwater, only two air monitoring points will be required for each location. Soil gas oxygen and carbon

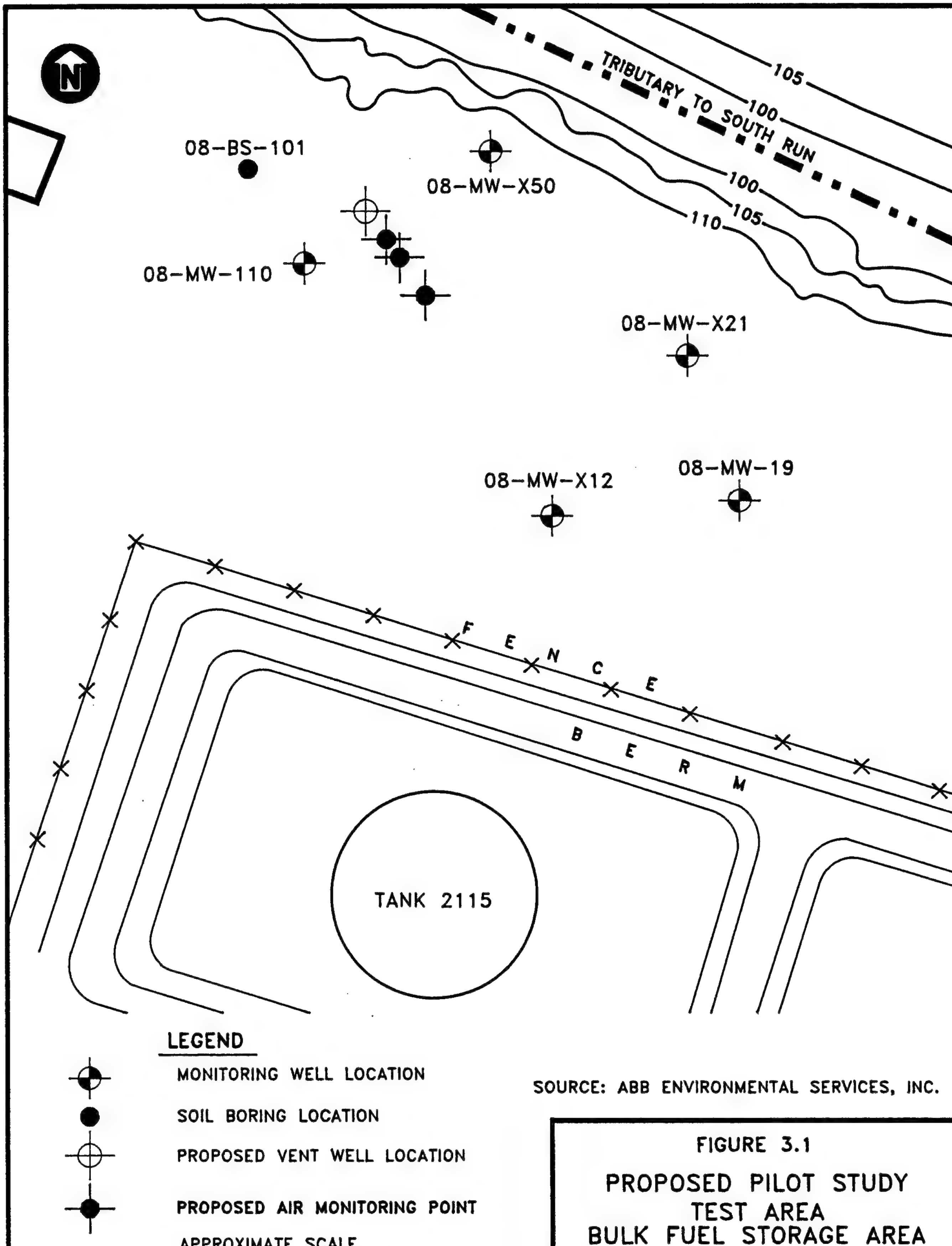

FIGURE 3.1

PROPOSED PILOT STUDY TEST AREA BULK FUEL STORAGE AREA

McGuire AFB, New Jersey

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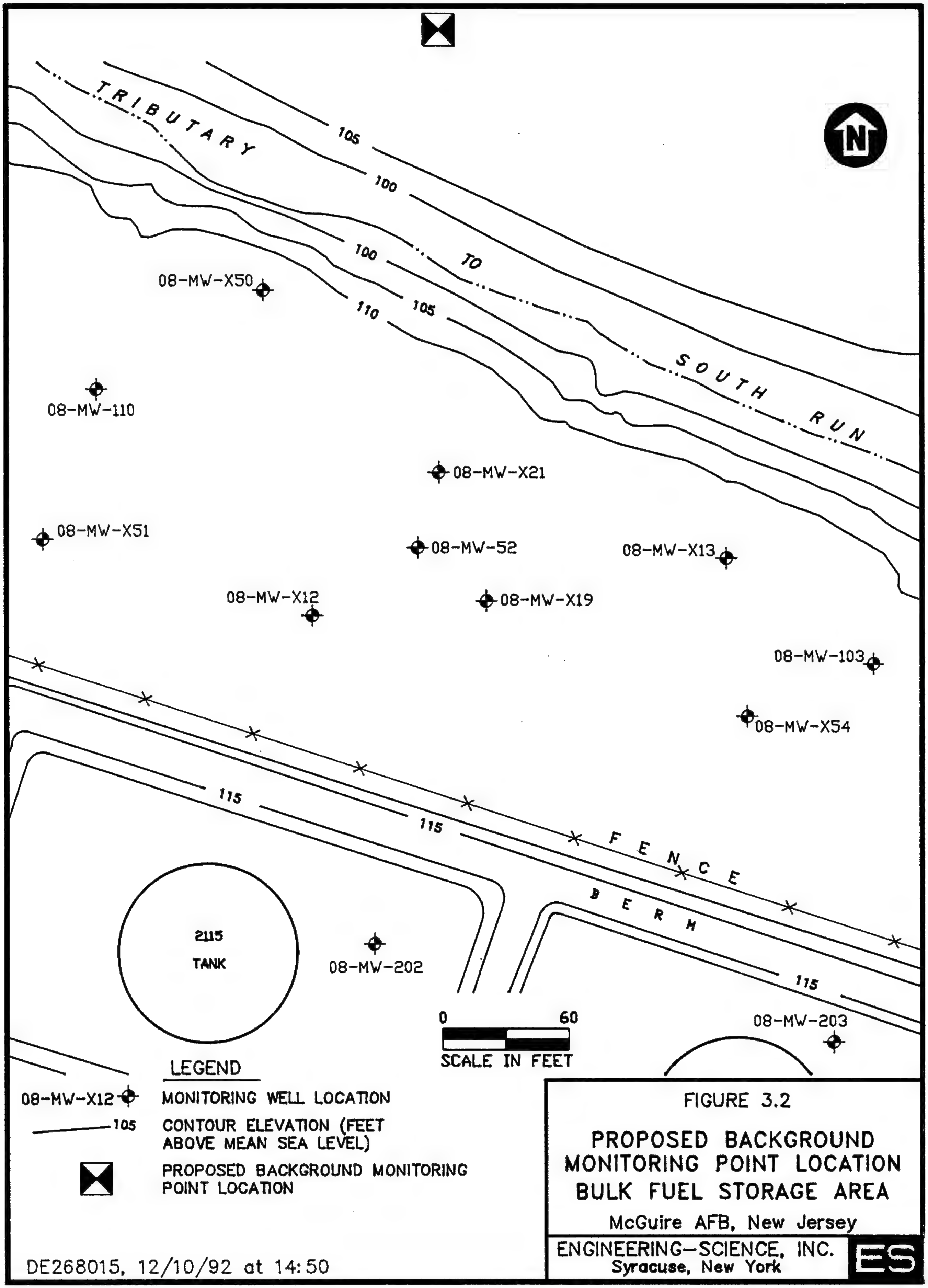


TRIBUTARY TO SOUTH RUN
105
100
100
110
105
08-MW-X50
08-MW-110
08-MW-X21
08-MW-X51
08-MW-52
08-MW-X13
08-MW-X12
08-MW-X19
08-MW-103
08-MW-X54
115
115
FENCE
BERM
115
2115
TANK
08-MW-202
0
60
SCALE IN FEET
08-MW-203
LEGEND
08-MW-X12
MONITORING WELL LOCATION
105
CONTOUR ELEVATION (FEET ABOVE MEAN SEA LEVEL)
PROPOSED BACKGROUND MONITORING POINT LOCATION
FIGURE 3.2
PROPOSED BACKGROUND MONITORING POINT LOCATION BULK FUEL STORAGE AREA
McGuire AFB, New Jersey
ENGINEERING-SCIENCE, INC.
Syracuse, New York
ES
DE268015, 12/10/92 at 14:50

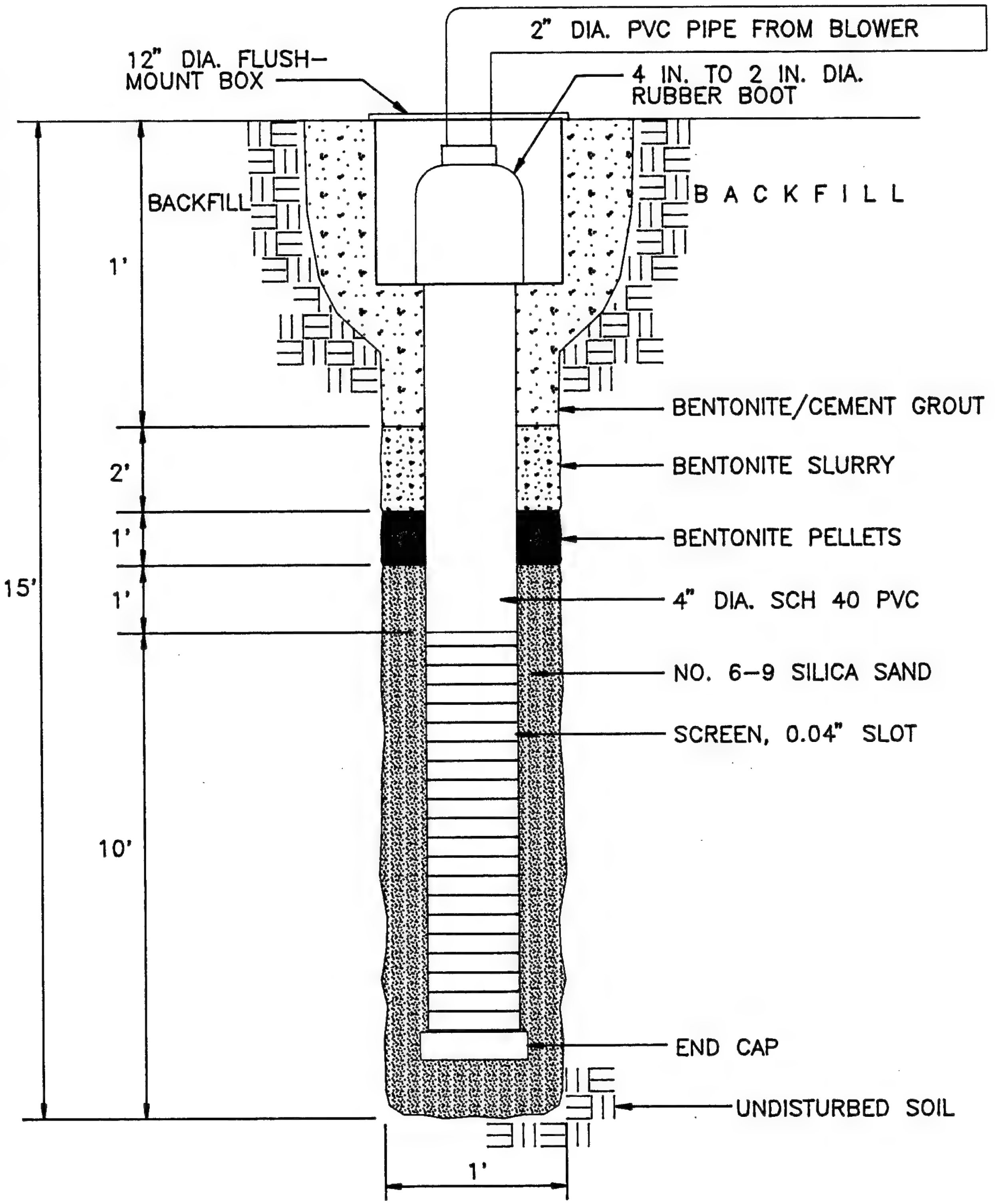


FIGURE 3.3

INJECTION VENTING WELL CONSTRUCTION DETAIL BULK FUEL STORAGE AREA

McGuire AFB, New Jersey

ENGINEERING-SCIENCE, INC.
Syracuse, New York

DE268007, 12/10/92 at 13:40

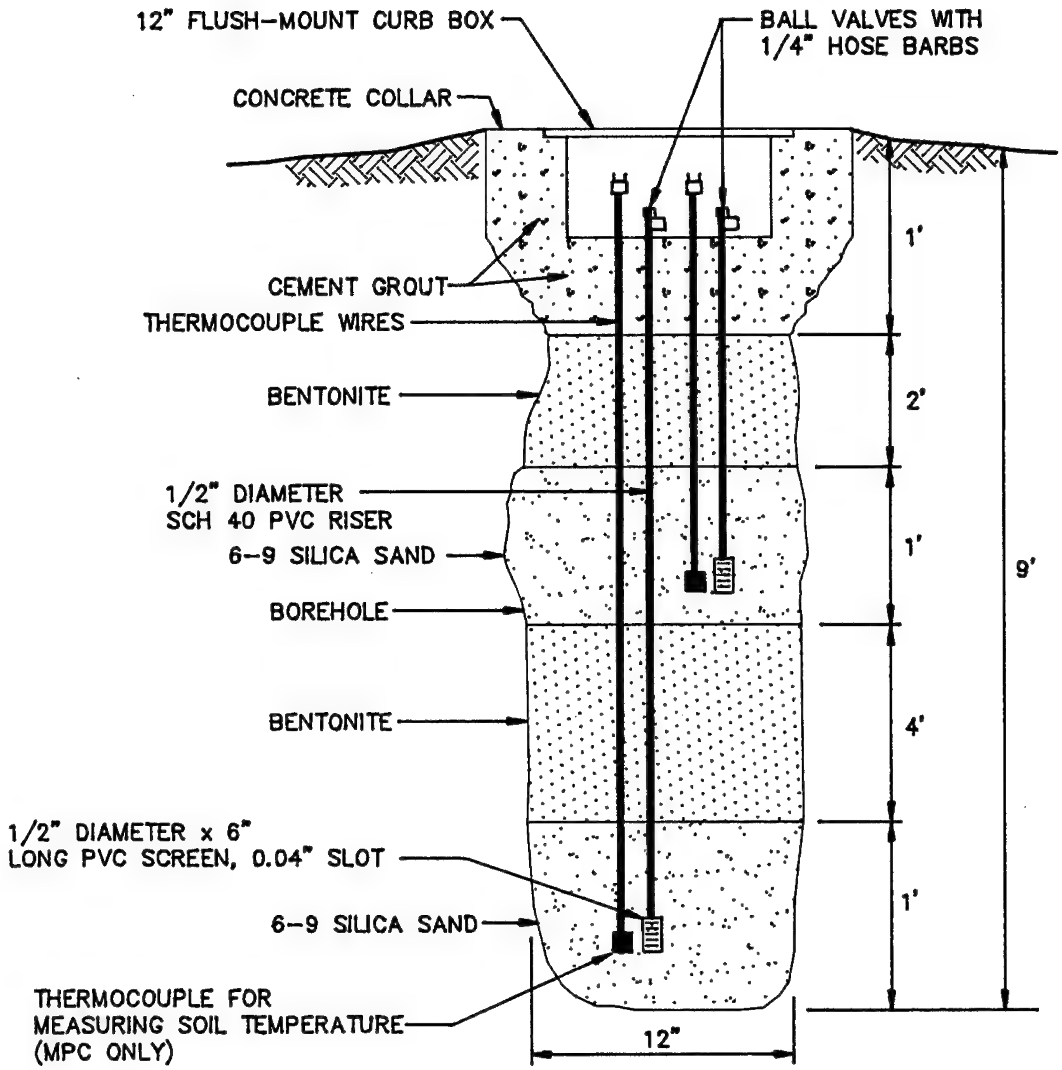


FIGURE 3.4

MONITORING POINT CONSTRUCTION DETAIL BULK FUEL STORAGE AREA

McGuire AFB, New Jersey

ENGINEERING-SCIENCE, INC.
Syracuse, New York

DE268006, 12/10/92 at 14:44

dioxide concentrations will be monitored at depth intervals of approximately 3-4 feet and 8-9 feet at each location. Multi-depth monitoring will confirm that the entire soil profile is receiving oxygen and be used to measure fuel biodegradation rates at both depths. The annular space between these two monitoring points will be sealed with bentonite to isolate the monitoring intervals. As with the central vent well, several inches of bentonite pellets will be used to shield the filter pack from rapid infiltration of bentonite slurry additions. Additional details on vent well and monitoring point construction are found in Section 4 of the protocol document.

3.3 Handling of Drill cuttings

Drill cuttings from all borings will be left at each location in accordance with the current procedures for ongoing remedial investigations.

3.4 Soil Sampling

Three soil samples will be collected from the pilot test area during the installation of the vent well and monitoring points. One sample will be collected from the most contaminated interval of the central vent well boring, and one sample will be collected from the interval of highest apparent contamination in two of the borings for the three air monitoring points. Continuous split spoon sampling will be performed during the vent well and air monitoring point installations. The sample with the highest headspace PID reading from each boring will be selected for analysis. Soil samples will be analyzed for TPH, BTEX, soil moisture, pH, particle sizing, alkalinity, total iron and nutrients.

Samples will be collected using a split-spoon sampler containing brass tube liners. A photoionization detector or total hydrocarbon vapor analyzer (see protocol Section 4.5.2) will be used to insure that breathing zone levels of volatiles do not exceed 1 ppm during drilling and to screen split spoon samples for intervals of high fuel contamination. Soil samples collected in the brass tubes will be immediately trimmed and aluminum foil and a plastic cap placed over the ends. Soil samples will be labelled following the nomenclature specified in the protocol document(Section 5.5), wrapped in plastic, and placed in an ice chest for shipment. A chain of custody form will be filled out and the ice chest shipped to the Engineering Science laboratory in Berkeley, California for analysis. This laboratory has been audited by the U.S. Air Force and meets all their quality assurance/quality control and certification requirements.

3.5 Air Injection System

A 1-horsepower regenerative blower capable of injecting 30 - 70 scfm will be used to conduct the initial air permeability test at these sites. This blower provides a wide range of flow rates and should develop sufficient pressure to move air through moderate permeability soils. Air injection will be used to provide oxygen to soil bacteria and to minimize emissions of volatiles to the atmosphere. If initial testing indicates that less pressure is required to supply oxygen throughout the test volume, a smaller blower will be installed for extended testing at the site.

An extended pilot test will be performed at the BFSA site if initial pilot testing is positive. The extended bioventing test will be initiated following regulatory

approval. Figure 3.5 is a schematic of a typical air injection system that will be used for long-term pilot testing at these sites.

The maximum power requirement anticipated for this pilot test is a 230-Volt, Single-Phase, 50 Amp service. Additional details on power supply requirements are described in Section 5.0, Base Support Requirements.

4.0 EXCEPTIONS TO PROTOCOL PROCEDURES

No exceptions to the attached protocol are anticipated at this site.

5.0 BASE SUPPORT REQUIREMENTS

The following base support is needed prior to the arrival of a driller and the Engineering-Science test team:

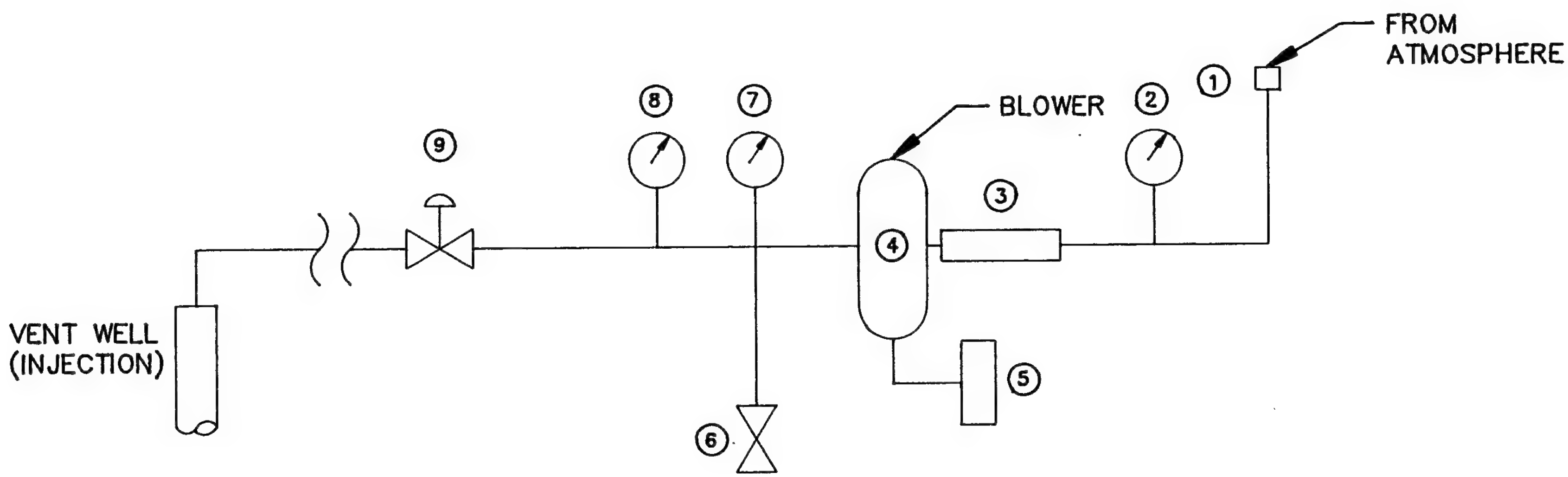
- Confirmation of regulatory approval for the pilot test.
- Assistance in obtaining a digging permit at each site.
- A breaker box within 100 feet of the site which can supply 230 Volt, Single-Phase 50 Amp service for the initial and extended pilot test.
- Provide any paperwork required to obtain gate passes and security badges for approximately two Engineering Science employees and two drillers. Vehicle passes will be needed for two trucks and a drill rig.

During the initial three week pilot test the following base support is needed:

- Twelve square feet of desk space and a telephone in a building located as near to the site as practical.
- The use of a fax machine for transmitting 15 to 20 pages of test results.

During the one year extended pilot test on the BFSA site:

- Check the blower system at least once a week to ensure that it is operating and to record the air injection pressure. Engineering-Science will provide a brief training session on this procedure.
- Notify Mr. David Brown ES-Syracuse (315) 451-9560, Mr. Doug Downey, Engineering-Science, Inc., Denver (303) 831-8100, or Mr. Jim Williams of the AFCEE, (800) 821-4528, ext. 293 if the blower or motor stop working.
- Arrange site access for an Engineering-Science technician to conduct *in situ* respiration tests approximately six months and one year after the initial pilot test.



1. INLET FILTER
2. VACUUM GAUGE – INCHES OF H20
3. DRIVE MOTOR
   1 HP / 2850 RPM @ 60 Hz / 230 v / SINGLE PHASE / 15 A /
4. BLOWER – GAST R4110-2
   60 SCFM @ 30 INCHES H_2O / REGENERATIVE
5. STARTER
   230 v / 27 A / SINGLE PHASE / H1036 HEATER (10.8 A)
6. AUTOMATIC PRESSURE RELIEF VALVE – SET @ 42 INCHES H_2O
7. PRESSURE GAUGE (INCHES OF H_2O)
8. THERMOMETER (FAHRENHEIT)
9. MANUAL PRESSURE RELIEF (BLEED) VALVE – 1 1/2" BALL

DE268013, 12/10/92 at 10:19

FIGURE 3.5

SCHEMATIC OF BLOWER SYSTEM FOR AIR INJECTION BULK FUELS STORAGE AREA

McGuire AFB, New Jersey

ENGINEERING–SCIENCE, INC.
Syracuse, New York

ES

6.0 PROJECT SCHEDULE

The following schedule is contingent upon timely approval of this pilot test work plan.

Event	Date
Draft Test Work Plan to AFCEE	17 August 1992
Submit Test Plan for Regulatory Approval	21 August 1992
Regulatory Approval To Proceed	31 August 1992
Begin Pilot Test	14 September 1992
Complete Initial Pilot Test	2 October 1992
Interim Results Report	20 October 1992
Respiration Test	March 1993
Final Respiration Test	September 1993

7.0 POINTS OF CONTACT

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Mr. David A. Brown
Engineering-Science, Inc
290 Elwood Davis Road, Suite 312
Liverpool, New York 13088
(315) 451-9560

PART II

DRAFT

INTERIM PILOT TEST RESULTS REPORT

for the

BULK FUEL STORAGE AREA SITE

MCGUIRE AFB, NEW JERSEY

Prepared for:

Air Force Center for Environmental Excellence

Brooks AFB, Texas

and

438th Civil Engineering Squadron and

Environmental Management Branch

McGuire AFB, New Jersey

December 1992

Prepared by:

Engineering-Science, Inc.
1700 Broadway, Suite 900
Denver, Colorado 80290

A7-16-2

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PART II - BIOVENTING PILOT TEST RESULTS REPORT FOR BULK FUEL STORAGE AREA SITE MCGUIRE AFB, NEW JERSEY

TABLES

FIGURES

PART II

DRAFT INTERIM TEST RESULTS

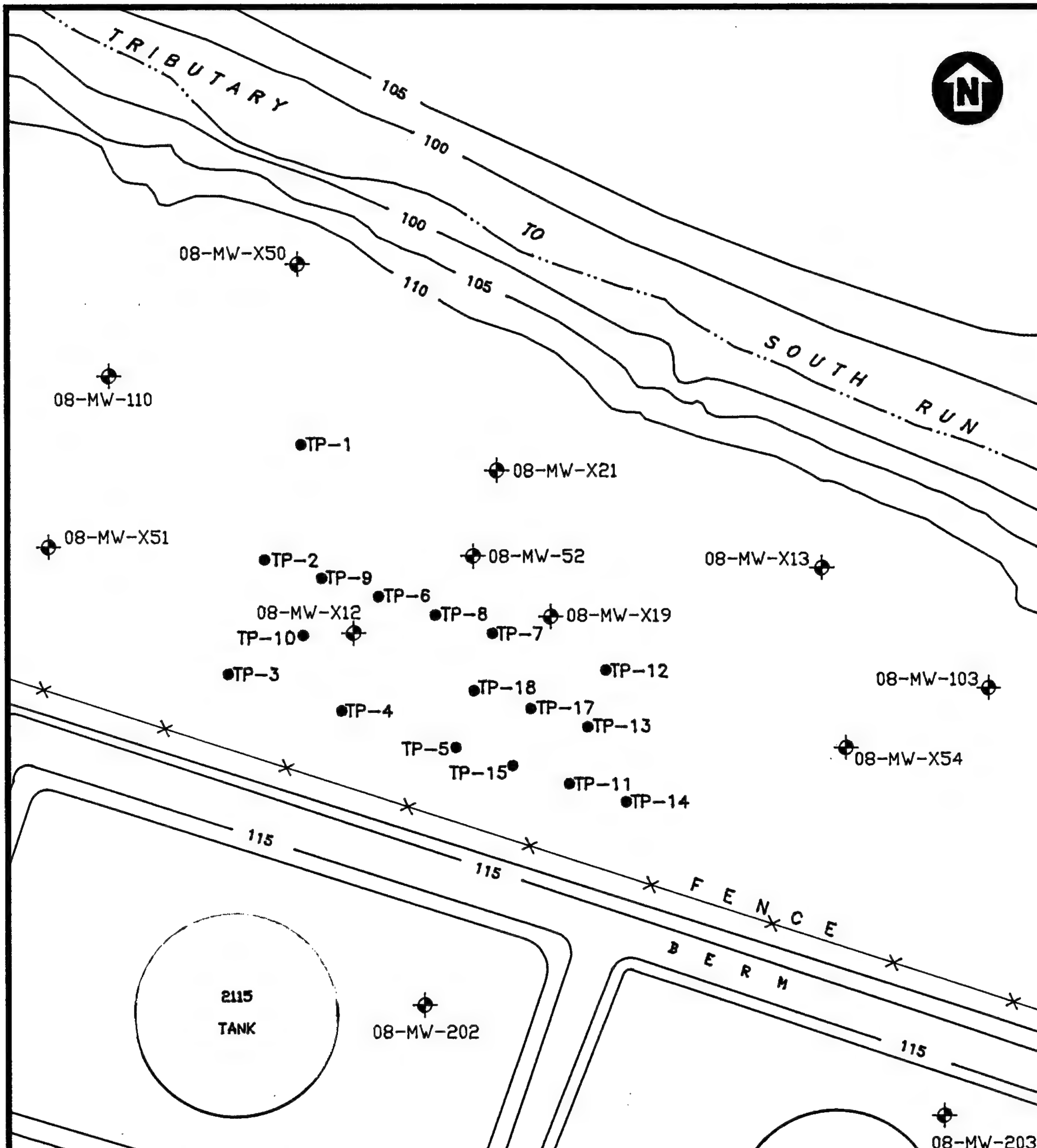
An initial bioventing pilot test was completed at the Bulk Fuel Storage Area (BFSA) at McGuire Air Force Base, New Jersey, during the period of October 5 through 16, 1992. The purpose of Part II interim test results report is to describe the results of the initial pilot test at the site and to made specific recommendations for extended testing to determine the long-term impact of bioventing on site contaminants. Descriptions of the site history, geology, and contaminants at the BFSA are contained in Part I, the Pilot Test Work Plan.

1.0 PILOT TEST DESIGN AND CONSTRUCTION

An oxygen and total volatile petroleum hydrocarbon (TVPH) soil vapor survey was conducted at the BFSA prior to the installation of the bioventing pilot test vent well (VW) and vapor monitoring points (MPs). This survey was conducted to determine the optimum location for conducting the bioventing pilot test and was conducted on August 5 and 6, 1992. The survey consisted of driving hollow stainless steel probes into the ground surface of the field north of the BFSA and analyzing the soil gas for oxygen and TVPH.

A 50-foot by 50-foot grid was laid out in the field and sampling probes were installed at the grid nodes. Based on measurements collected at the grid nodes, additional probes were placed at intermediate grid locations to better define the area of highest contamination. Low oxygen and high soil gas TVPH were used as selection criteria for locating the pilot test area. Based on the results of the survey, a location approximately 100 feet north of the storage tanks and between Tanks 2115 and 2114 was chosen as the test location. Figure 1.1 presents the soil vapor survey point locations and the pilot test area location. Table 1.1 presents the results of the soil vapor survey.

Installation of the air injection VW and MPs at the chosen pilot test location began on October 7, 1992 and was completed on October 8, 1992. One VW and three MPs (MPA, MPB, and MPC) were installed in the field north of the BFSA in the area of highest contamination found. A single background MP was installed approximately 500 feet north of the pilot test area on the north side of the South Run Tributary. The background MP was installed at this location because the tributary is thought to be a hydraulic barrier to contaminant migration. Figure 1.2 depicts the pilot test VW and MP locations. Figure 1.3 depicts the vertical profile of the pilot test area.



LEGEND

08-MW-X12	MONITORING WELL LOCATION
105	CONTOUR ELEVATION (FEET ABOVE MEAN SEA LEVEL)
TP-1	SOIL VAPOR SURVEY SAMPLING POINT LOCATION

SCALE IN FEET
0 60

DE268011, 12/10/92 at 11:06

FIGURE 1.1

SOIL VAPOR SURVEY POINTS
BULK FUEL STORAGE AREA
McGuire AFB, New Jersey

ENGINEERING-SCIENCE, INC.
Syracuse, New York

ES

TABLE 1.1

SOIL VAPOR SURVEY RESULTS
BULK FUEL STORAGE AREA
MCGUIRE AIR FORCE BASE, NEW JERSEY

Date	Test Point ID	Depth (feet bgs)[c/]	O_2 (percent)	CO_2 (percent)	TVPH Concentration (ppmv)[b/]	Remarks
6 October	TP1	3	NS[c/]	NS	NS	Hydrocarbon odor on probe
	TP2	3	3.0	9.3	NS	
	TP2	6	3.5	9.2	NS	May have had leak in probe
	TP3	3	NS	NS	NS	Could not draw vacuum
	TP4	3	NS	NS	NS	Could not draw vacuum
	TP6	2.5	1.6->0.8	11.5->11.6	600	No hydrocarbon odor noted
	TP6	5	NS	NS	NS	Could not draw vacuum
	TP6	5	6.0	7.0	640	Hydrocarbon odor on probe
	TP7	3	NS	NS	NS	Could not draw vacuum
	TP8	3	1.8	10.5	590	
	TP8	5	5.8	8.8	480	Hydrocarbon odor on probe
	TP9	3	5.0	8.5	390	
	TP9	6	NS	NS	NS	Could not draw vacuum
	TP10	3	7.0	8.0	470	
	TP10	5	10.5	6.0	540	
	TP11	3	1.1	9.5	1980	Strong hydrocarbon odor in pump exhaust
	TP11	6	NS	NS	NS	Could not draw vacuum
	TP12	3	16.0	4.0	NS	

A7-16-12

TABLE 1.1 (Continued)

SOIL VAPOR SURVEY RESULTS
BULK FUEL STORAGE AREA
MCGUIRE AIR FORCE BASE, NEW JERSEY

Date	Test Point ID	Depth (feet bgs)[c]	O_2 (percent)	CO_2 (percent)	TVPH Concentration (ppmv)[b]	Remarks
	TP13	2.5	12.0	5.0	NS	
	TP5	3	NS	NS	NS	Could not draw vacuum
	TP14	3	15.0	NS	1080	Strong hydrocarbon odor in pump exhaust
7 October	TP15	3	4.0	8.5	NF[d]	Strong hydrocarbon odor in pump exhaust
	TP15	6	NS	NS	NF	Could not draw vacuum
	TP17	3	NS	NS	NF	Ground water encountered - could not monitor soil gas
	TP18	3	NS	NS	NF	Ground water encountered - could not monitor soil gas

a/ bgs = Below ground surface.
b/ TVPH = Total volatile petroleum hydrocarbons; ppmv = parts per million, volume per volume
c/ NS = Not sampled.
d/ NF = TVPH Meter not functioning properly.

A7-16-12

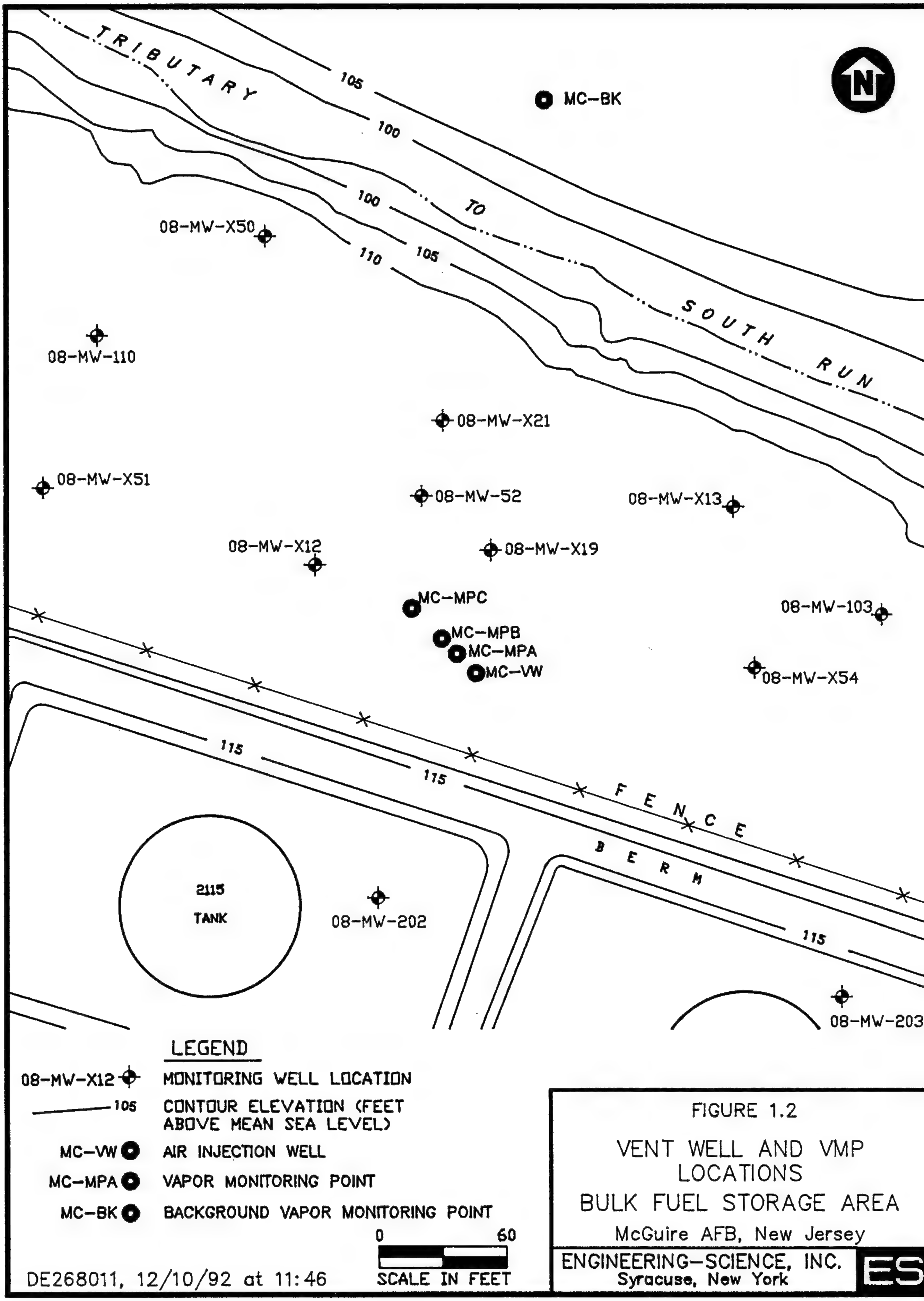


FIGURE 1.2

VENT WELL AND VMP LOCATIONS
BULK FUEL STORAGE AREA
McGuire AFB, New Jersey

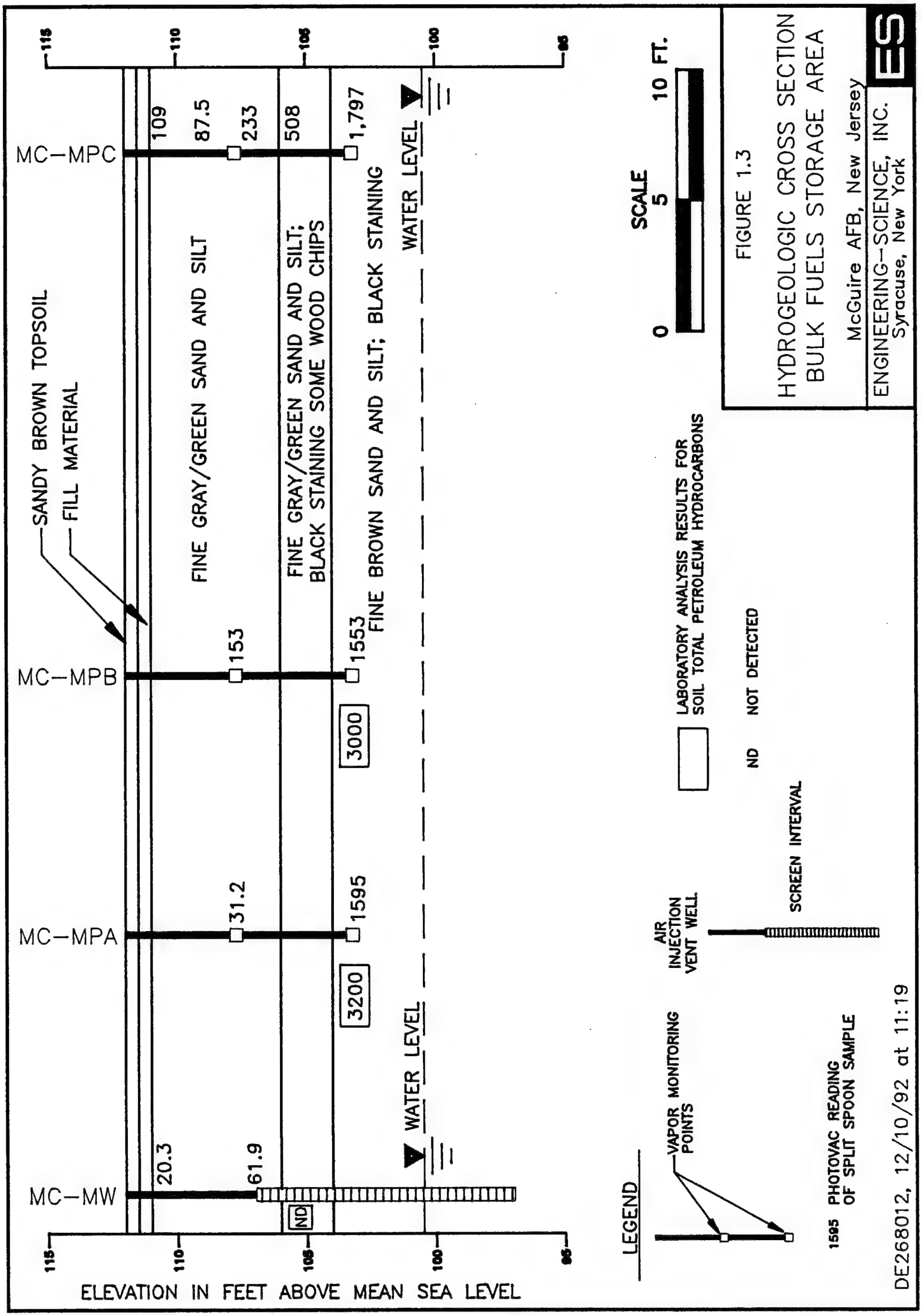


FIGURE 1.3
HYDROGEOLOGIC CROSS SECTION
BULK FUELS STORAGE AREA
McGuire AFB, New Jersey

1.1 Air Injection Vent Well

The air injection VW was installed following procedures described in the protocol document (Hinchee et al., 1992). Figure 1.4 shows the as-built construction detail of the VW. The VW was installed in the area of highest contamination encountered during the soil vapor survey. The screened interval of the VW extended approximately 3 feet into the groundwater to allow for seasonal fluctuations. The VW was constructed of 4-inch diameter, Schedule 40 polyvinyl chloride (PVC) casing, with 10 feet of 0.04-inch-slot well screen installed from 5 to 15 feet below the ground surface (bgs). The annular space between the well screen and the borehole was filled with 6-9 graded silica sand from the bottom of the borehole to approximately 1 foot above the screen interval. A 1-foot layer of bentonite pellets was place on top of the sand and hydrated in place. A 3-foot layer of bentonite slurry was placed above the hydrated bentonite pellets. The top of the well was finished with a 12-inch diameter flush mount box which was cemented in place.

1.2 Monitoring Points

The monitoring point screens in the MPs were installed at depths of 3.5 feet and 8.5 feet bgs in the pilot test area. The monitoring point screens in the background well were installed at depths of 3.5 feet and 6.5 feet bgs due to a higher groundwater table on the north side of the South Creek tributary. Figure 1.5 shows the typical as-built construction detail for the MPs. Each monitoring point was constructed of a 6-inch section of 1/2-inch PVC 0.04-inch-slot well screen attached to 1/2-inch PVC riser pipe which extended to the ground surface. A 1/2-inch PVC ball valve and 1/4-inch hose barb were installed on top of each riser pipe to allow for connection to the monitoring equipment. Type K thermocouples were installed along with the monitoring points in MPC, which was furthest away from the VW. These thermocouples were used to monitor soil temperature during the pilot tests. The top of each MP was completed by installing a 12-inch diameter flush-mount box, which was cemented in place.

1.3 Blower Unit

A 1-horsepower regenerative blower unit manufactured by Gast, Inc. was used for the initial pilot test. This unit was then semipermanently installed for use during the extended pilot test. The unit was connected to the VW via a 4-inch to 2-inch reducing Fernco® couple installed at the well head. The unit was energized by 230-volt, single-phase, 30-amp line power from a new power pole installed by McGuire AFB Exterior Electricians. The blower is capable of injecting 70 standard cubic feet of air per minute (SCFM) at 20 inches of water pressure. During the initial pilot test, the blower was operated at a pressure of 42 inches of water which yielded an air injection rate of 30 SCFM. During startup of the extended pilot test the air injection rate will be adjusted to 30 scfm or less. The configuration and specifications for the blower system are shown on Figure 1.6.

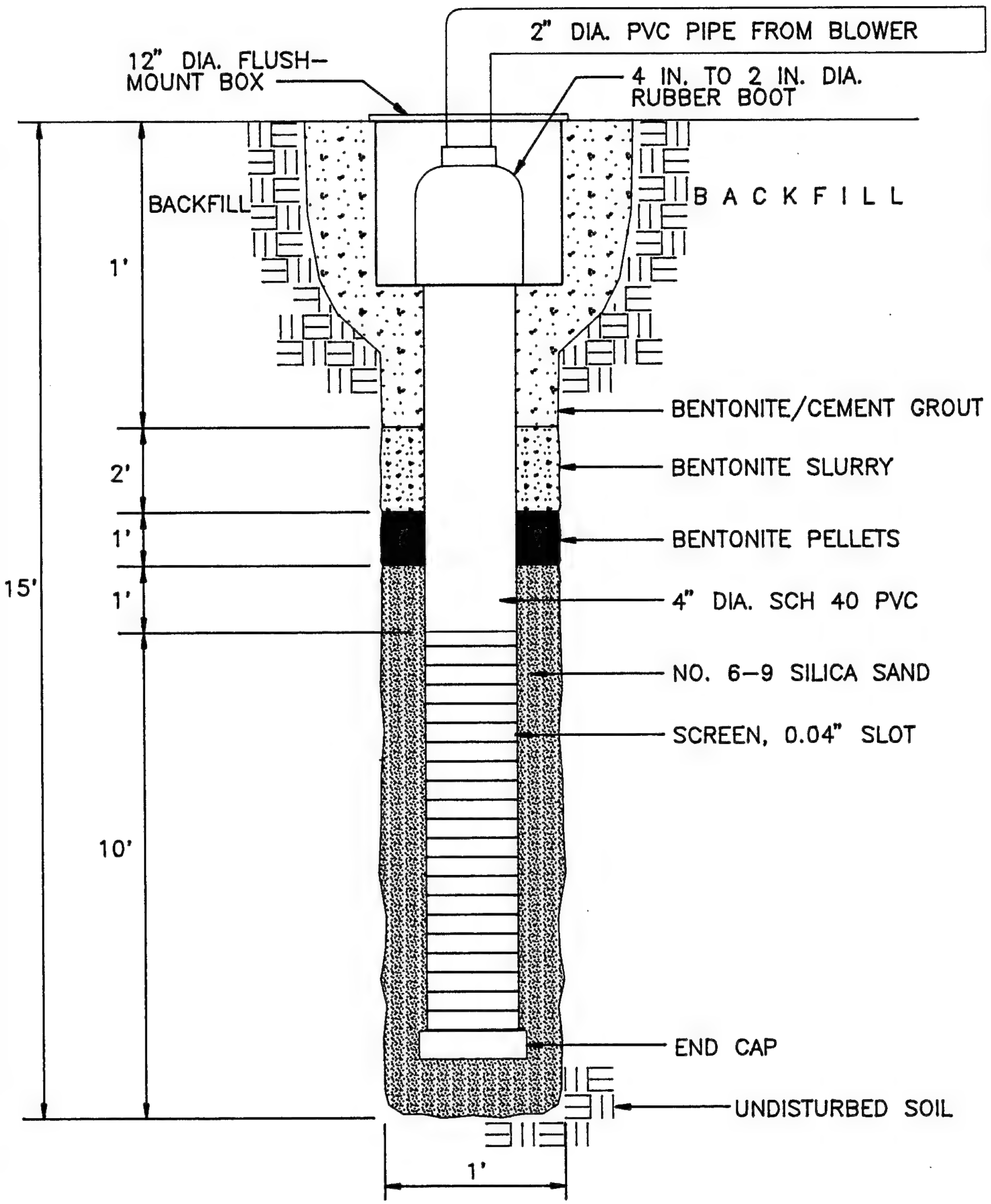


FIGURE 1.4

AS-BUILT AIR INJECTION VENT WELL CONSTRUCTION DETAIL BULK FUEL STORAGE AREA

McGuire AFB, New Jersey

ENGINEERING-SCIENCE, INC.
Syracuse, New York

DE268007, 12/10/92 at 14:39

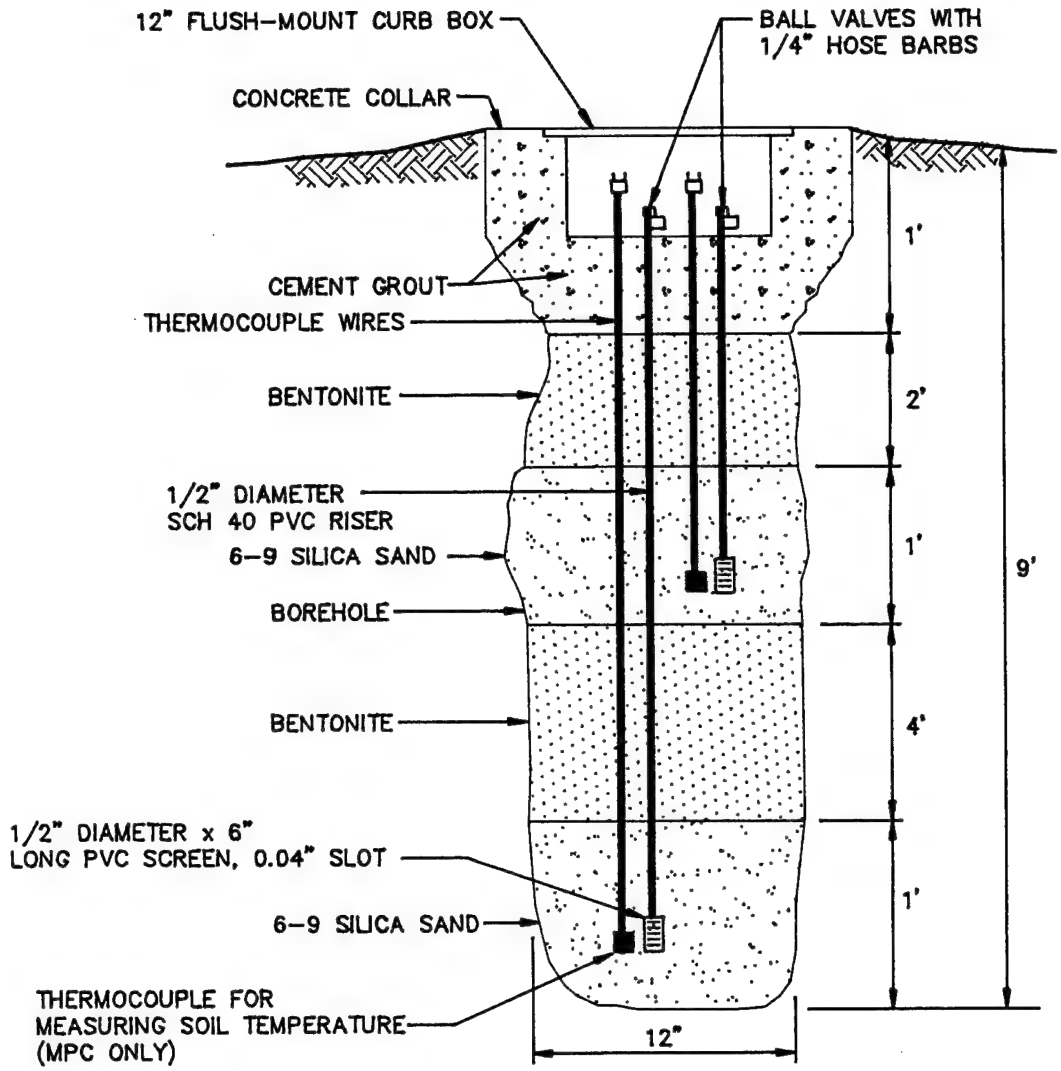


FIGURE 1.5

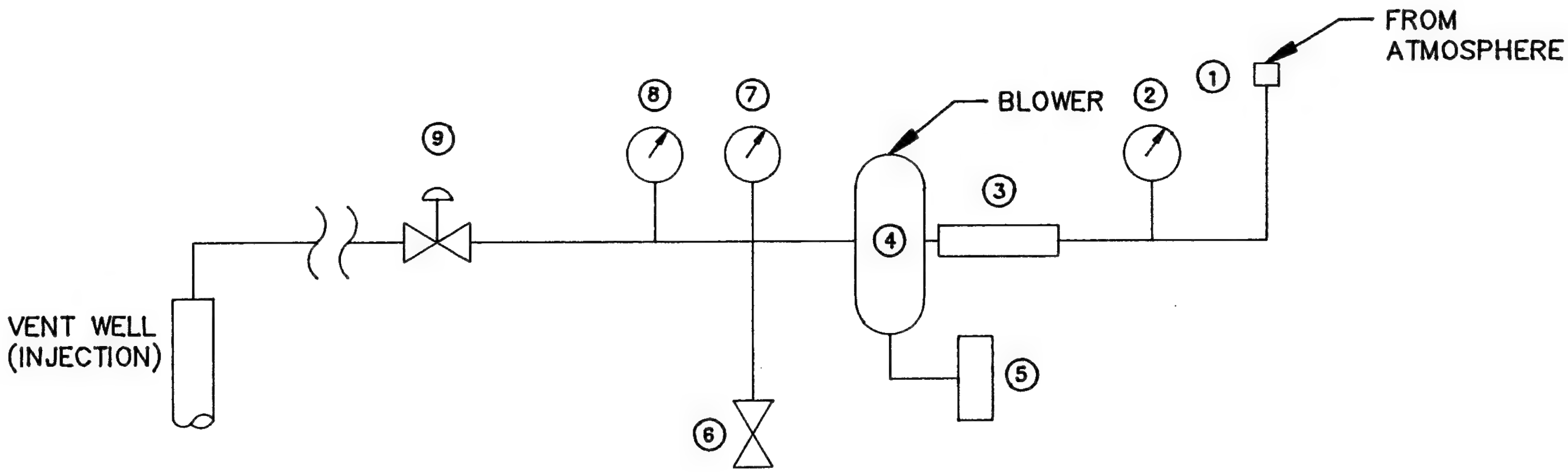
AS-BUILT MONITORING POINT CONSTRUCTION DETAIL BULK FUEL STORAGE AREA

McGuire AFB, New Jersey

ENGINEERING-SCIENCE, INC.
Syracuse, New York

ES

DE268006, 12/10/92 at 14:44



1. INLET FILTER
2. VACUUM GAUGE – INCHES OF H20
3. DRIVE MOTOR
1 HP / 3450 RPM @ 60 Hz / 230 v / SINGLE PHASE / 15 A /
4. BLOWER – GAST R4110-2
70 SCFM @ 20 INCHES H_2O / REGENERATIVE
5. STARTER
230 v / 27 A / SINGLE PHASE / H1036 HEATER (10.8 A)
6. AUTOMATIC PRESSURE RELIEF VALVE – SET @ 42 INCHES H_2O
7. PRESSURE GAUGE (INCHES OF H_2O)
8. THERMOMETER (FAHRENHEIT)
9. MANUAL PRESSURE RELIEF (BLEED) VALVE – 1 1/2" BALL

DE268001, 12/10/92 at 09:55

FIGURE 1.6

AS BUILT BLOWER SYSTEM FOR AIR INJECTION BULK FUEL STORAGE AREA

McGuire AFB, New Jersey

ENGINEERING-SCIENCE, INC.
Syracuse, New York

2.0 PILOT TEST SOIL AND SOIL GAS SAMPLING RESULTS

2.1 Sampling Results

Soils at the site consist of fine sand and silt from 1 to greater than 15 feet bgs. Black staining was noted from 6 feet bgs to the water table at approximately 12 feet bgs. The top foot of soil consists of fill material covered by topsoil (Figure 1.3). Hydrocarbon contamination at this site was generally observed from the ground surface to the groundwater table at approximately 12 feet below grade. Contamination was identified based on visual appearance, odor, and field screening for volatile organic compounds (VOCs). Heavily contaminated soils were stained grey in color, had a strong hydrocarbon odor, and had photoionization detector (PID) readings well above background levels. All split-spoon samples were characterized based on the above criteria to determine the presence of contamination and to allow for selection of samples to be sent for laboratory analysis.

Soil samples for laboratory analysis were collected from the VW at 7 feet bgs, from MPA at 9 feet bgs, and from MPB at 9 feet bgs. Procedures specified in the protocol document (Hinchee et al., 1992) were used for soil sample collection. Soil gas samples were collected by extracting soil gas from the VW and from MPA at 8.5 feet bgs. Soil samples were packed on ice and shipped via Federal Express® to the ES Berkeley Laboratory for chemical [total recoverable petroleum hydrocarbons (TRPH) and benzene, toluene, ethylbenzene, and xylenes (BTEX)] and physical analysis. Soil gas samples were shipped via Federal Express® to Air Toxics Ltd. in Rancho Cordova, California for total volatile hydrocarbons (TVH) and BTEX analysis. The results of these analyses are presented in Table 2.1.

2.2 Exceptions to Test Protocol Document Procedures

Procedures described in the protocol document (Hinchee et al., 1992) were used to complete treatability tests at this site. Only two soil gas samples were collected for laboratory analysis. All other procedures followed the protocol document.

2.3 Field QA/QC Results

Five percent of the samples collected throughout the AFCEE bioventing program are to be field quality assurance/quality control (QA/QC) samples (duplicates). Because this level of QA/QC samples has been met by field duplicates submitted from other sites, no field duplicates were collected at McGuire AFB.

3.0 PILOT TEST RESULTS

3.1 Initial Soil Gas Chemistry

Prior to any air injection at the BFSA pilot test area, the VW and all MPs were purged to remove stale gas to allow for monitoring of initial soil gas concentrations of oxygen, carbon dioxide, and TVH. The VW was purged for 5 minutes, and the MPs were purged for 1 minute. Soil gas sampling was conducted using portable gas analyzers as described in the technical protocol document (Hinchee et al., 1992). MPB-8 could not be sampled because water had entered the MP. Table 3.1 summarizes the initial soil gas chemistry at the site. The data in Table 3.1 also

TABLE 2.1

BULK FUEL STORAGE AREA

SOIL AND SOIL GAS ANALYTICAL RESULTS

Analyte (Units)[a]	Sample Location-Depth (feet below ground surface)		
Soil Hydrocarbons	VW-7	MPA-9	MPB-9
TRPH (mg/kg)	ND[b]	3200	3000
Benzene (mg/kg)	0.0021	ND	13
Toluene (mg/kg)	0.0063	160	180
Ethylbenzene (mg/kg)	ND	300	45
Xylenes (mg/kg)	ND	260	350
Soil Gas Hydrocarbons	VW	MPA-8	
TVH (ppmv)	88,000	20,000	
Benzene (ppmv)	120	25	
Toluene (ppmv)	320	61	
Ethylbenzene (ppmv)	28	5.2	
Xylenes (ppmv)	93	22	
Soil Inorganics	VW-7	MPA-9	MPB-9
Iron (mg/kg)	7610	4550	5340
Alkalinity (mg/kg as $CaCO_3$)	ND	61	ND
pH (units)	6.6	5.9	5.7
TKN (mg/kg)	390	620	440
Phosphates (mg/kg)	270	170	210
Soil Physical Parameters	VW-7	MPA-9	MPB-9
Moisture (% wt.)	10.0	18.1	19.1
Gravel (%)	0.5	1	2
Sand (%)	42	35	53
Silt (%)	43.5	56	37
Clay (%)	14	8	8

a/ TRPH = total recoverable petroleum hydrocarbons; mg/kg = milligrams per kilogram; TVH = total volatile hydrocarbons; ppmv = parts per million, volume per volume (referenced to jet fuel); $CaCO_3$ = calcium carbonate; TKN = total Kjeldahl nitrogen.

b/ ND = not detected.

TABLE 3.1
IRP SITE 3 FIRE TRAINING AREA
INITIAL SOIL GAS CHEMISTRY
MCGUIRE AFB, NEW JERSEY

MP	Depth (ft)	0_2 (%)	CO_2(%)	Field TVH (ppmv)	Lab TVH (ppmv)	TRPH (mg/kg)
A	3	2.5	8.0	4,800	NS	NS
B	3	19.0	1.0	4,000	NS	NS
C	3	11.0	4.0	18,800	NS	NS
A	8	1.0	>25.0	>20,000	20,000	3,200
B	8	NS[a]	NS	NS	NS	3,000
C	8	7.0	20.0	>20,000	NS	NS
VW	5-15	7.0	20.0	>20,000	88,000	ND[b]
BG	3	13.0	5.0	3,600	NS	NS
BG	6	2.0	7.0	13,000	NS	NS

[a]NS = not sampled, VMP placed in ground water.
[b]ND = not detected.

demonstrate the relationship between depleted oxygen levels and more contaminated soils. In highly contaminated soils, microorganisms have completely depleted soil gas oxygen supplies. In contrast, soil oxygen levels were higher in less contaminated soils. It should be noted that the intended background MP exhibited lower oxygen and higher TVPH concentrations than anticipated. It appears that this MP is in fuel-contaminated soils, or soils with some hydrocarbon vapor source that is not representative of clean soils in the area. A layer of black peat was encountered at a depth of approximately 4 to 9 feet in the intended background MP. This layer could be a source of methane or other hydrocarbon gases which exert a biological oxygen demand. A new background soil gas probe location will be sampled during the second respiration test.

3.2 Soil Gas Permeability

A soil gas permeability test was conducted according to protocol document procedures. Air was injected into the VW for 6 hours at a rate of approximately 30 scfm and an average pressure of approximately 42 inches of water. The pressure response at each MP is listed in Table 3.2. Using the HyperVentilate® model, soil gas permeabilities were calculated at 3.6, 3.3, and 73.2 darcys for MPA-3 MPA-8, and MPC-8, respectively. Not enough pressure response was detected at MPB-3 and MPC-3 to calculate permeabilities. Using the steady-state method, a soil gas permeability value of 7.1 darcys, typical for fine sand and silt soils, was calculated for this site. A radius of pressure influence of at least 40 feet was observed at the 8 foot depth.

3.3 Oxygen Influence

The depth and radius of oxygen increase in the subsurface resulting from air injection into the central VW during pilot testing is the primary design parameter for full-scale bioventing systems. Optimization of full-scale and multiple VW systems requires pilot testing to determine the volume of soil that can be oxygenated at a given flow rate and VW screen configuration.

Table 3.3 describes the change in soil gas oxygen levels that occurred during a 6-hour air injection test at the site. This relatively brief air injection period at 30 scfm produced changes in soil gas oxygen levels at a distance of at least 10 feet from the central VW. It is likely that oxygenated air will reach MPC with continuous injection. Based on measured pressure response, which is an indicator of long-term oxygen transport, it is anticipated that the radius of influence for a long-term bioventing system at this site will be between 20 and 40 feet at the 7-10 foot interval but will be less than 20 feet in the shallow soils. Monitoring during the extended pilot test at this site will better define the effective treatment radius.

3.4 In Situ Respiration Rates

The *in situ* respiration test was performed by injecting air (oxygen) into MPA-8 and BG-6 for a 22-hour period. A respiration test was conducted at the intended background MP to determine if the high hydrocarbon vapors discovered at this well exerted a biological oxygen demand. Following air injection, oxygen loss and other changes in soil gas composition were measured over time. Oxygen, TVH, and

TABLE 3.2

PRESSURE RESPONSE

AIR PERMEABILITY TEST

BULK FUEL STORAGE AREA

MCGUIRE AFB, NEW JERSEY

	Pressure Response In MP (inches of water)				
	MPA		MPB	MPC	
Depth (ft bgs)[a/] Elapsed Time (min.)[b/]	3	8	3	3	8
1	0.04	0.9	0	0	0.30
2	0.10	1.6	0	0	0.31
3	0.15	2.4	0	0	0.32
4	0.19	3.0	0	0	0.32
5	0.23	3.6	0	0	0.33
6	0.26	4.1	0	0	0.33
7	0.28	4.5	0	0	0.34
8	0.30	4.5[c/]	0	0	0.36
9	0.33	5.0	0	0	0.38
10	0.36	5.5	0	0	--
12	0.39	6.3	0	0	0.40
14	0.41	6.8	0	0	0.48
16	0.43	7.2	0	0	0.51
18	0.44	7.5	0	0	0.54
20	0.46	7.9	0	0	0.60
23	0.48	8.2	0	0	0.67
26	0.46	8.6	0	0	0.76
29	0.53	9.0	0	0	0.85
32	0.56	9.2	0	0	0.92
35	0.58	9.5	0	0	0.95
38	0.62	10.0	0	0	1.15
41	0.64	10.0	0	0	1.20
44	0.64	10.3	0	0	1.30
47	0.65	10.5	0	0	1.35
50	0.66	10.6	0	0	1.45
53	0.68	10.9	0	0	1.50
56	0.69	11.0	0	0	1.60
59	0.70	11.0	0	0	1.65
62	0.69	11.2	0	0	1.65
65	0.69	11.4	0	0	1.70
68	0.70	11.4	0	0	1.75
71	0.72	11.5	0	0	1.75

TABLE 3.2 (Continued)

PRESSURE RESPONSE

AIR PERMEABILITY TEST

BULK FUEL STORAGE AREA

MCGUIRE AFB, NEW JERSEY

	Pressure Response In MP (inches of water)				
	MPA		MPB	MPC	
Depth (ft bgs)[a/] Elapsed Time (min.)[b/]	3	8	3	3	8
74	0.72	11.5	0	01.80	
77	0.73	11.5	0	01.85	
80	0.74	11.5	0	01.90	
90	0.76	12.0	0	0.02	2.10
100	0.77	12.0	0	0.02	2.50
110	0.80	12.2	0	0.02	2.40
120	0.86	12.7	0	0.02	2.50
140	0.83	12.5	0.01	0.03	2.68
160	0.84	12.5	0.01	0.04	2.70
190	0.85	12.7	0.01	0.03	3.50
220	0.87	12.1	0.02	0.03	3.20
320	0.90	13.5	0.02	0.04	3.90
360	0.86	13.0[c/]	0.01	0.04	4.00

a/ ft bgs = Feet below ground surface.
b/ min. = minutes.
c/ Reading taken following soil gas measurement, pressure may have been temporarily lost from MP.

TABLE 3.3

INFLUENCE OF AIR INJECTION AT VENT WELL ON MONITORING POINT OXYGEN LEVELS

BULK FUEL STORAGE AREA
MCGUIRE AFB, NEW JERSEY

MP	Distance From VW (ft)	Depth(ft)	Initial O_2(%)	Final O_2(%)[a/]
A	10	8	0.0	14.0
C	40	8	0.0	0.0

a/ Test time=6 hours

carbon dioxide were measured for a period of 12 hours following air injection. The estimated oxygen diffusion loss was then subtracted from the measured oxygen loss to obtain the estimated biological oxygen utilization rate. The results of *in situ* respiration testing at this site are presented in Figure 3.1 and 3.2. Table 3.4 provides a summary of the observed and corrected oxygen utilization rates.

A 1-percent mixture of helium in air was injected into the BG-6 screened interval, and then the loss of helium was measured for 730 minutes following air injection. Because helium is a conservative, inert gas, the change in helium concentrations over time can be useful in determining if oxygen diffusion is responsible for a portion of the oxygen loss from each MP. Figure 3.3 compares oxygen utilization and helium retention at BG-6. During the respiration test, helium diffusion at BG-6 resulted in a fractional loss of approximately 52 percent of the initial helium concentration (Figure 3.3). Due to oxygen's greater molecular weight, helium will diffuse approximately three times faster than oxygen. This means that at BG-6, approximately 19 percent of the initial oxygen may have been lost due to diffusion. Based on initial oxygen levels in BG-6, oxygen diffusion occurred at a rate of approximately 0.005 percent per minute. Oxygen diffusion rates at MPA-8 were assumed to be similar to BG-6. The corrected oxygen utilization rates for BG-6 and MPA-8 is presented in Table 3.4.

Based on corrected oxygen utilization rates, approximately 900 milligrams (mg) of fuel per kilogram (kg) of soil can be degraded each year at this site. This estimate is based on an average air-filled porosity of 0.017 liter per kg of soil, and a conservative ratio of 3.5 mg of oxygen consumed for every 1 mg of fuel biodegraded.

3.5 Potential Air Emissions

Although soil concentrations of total BTEX compounds were detected at 720 mg/kg, air emissions were not detected in the breathing zone using both a TVH analyzer and a PID. Initial emissions should be minimal because accumulated vapors will move slowly outward from the air injection point and will be biodegraded as they move horizontally through the oxygenated soil. During the air permeability test, air was injected at 30 scfm for 6 hours. Health and safety monitoring with a PID indicated that hydrocarbon concentrations did not increase above 1 part per million, volume per volume (ppmv) in the ambient air during the test. Additional monitoring for air emissions will take place during the extended pilot test. If required, a flux chamber designed to capture any VOCs exiting the soil will be used during the first day of extended testing. A portable hydrocarbon analyzer will be used to quantify emissions, if they occur.

4.0 RECOMMENDATIONS

Initial bioventing tests at this site indicate that oxygen has been depleted in the contaminated soils, and that air injection is an effective method of increasing aerobic fuel biodegradation. The Air Force Center for Environmental Excellence (AFCEE) has recommended that air injection continue at this site to determine the long-term radius of oxygen influence and the effect of time, available nutrients, and changing temperatures on fuel biodegradation rates.

Figure 3.1
Respiration Test
Monitoring Point MPA-8
McGuire AFB, NJ

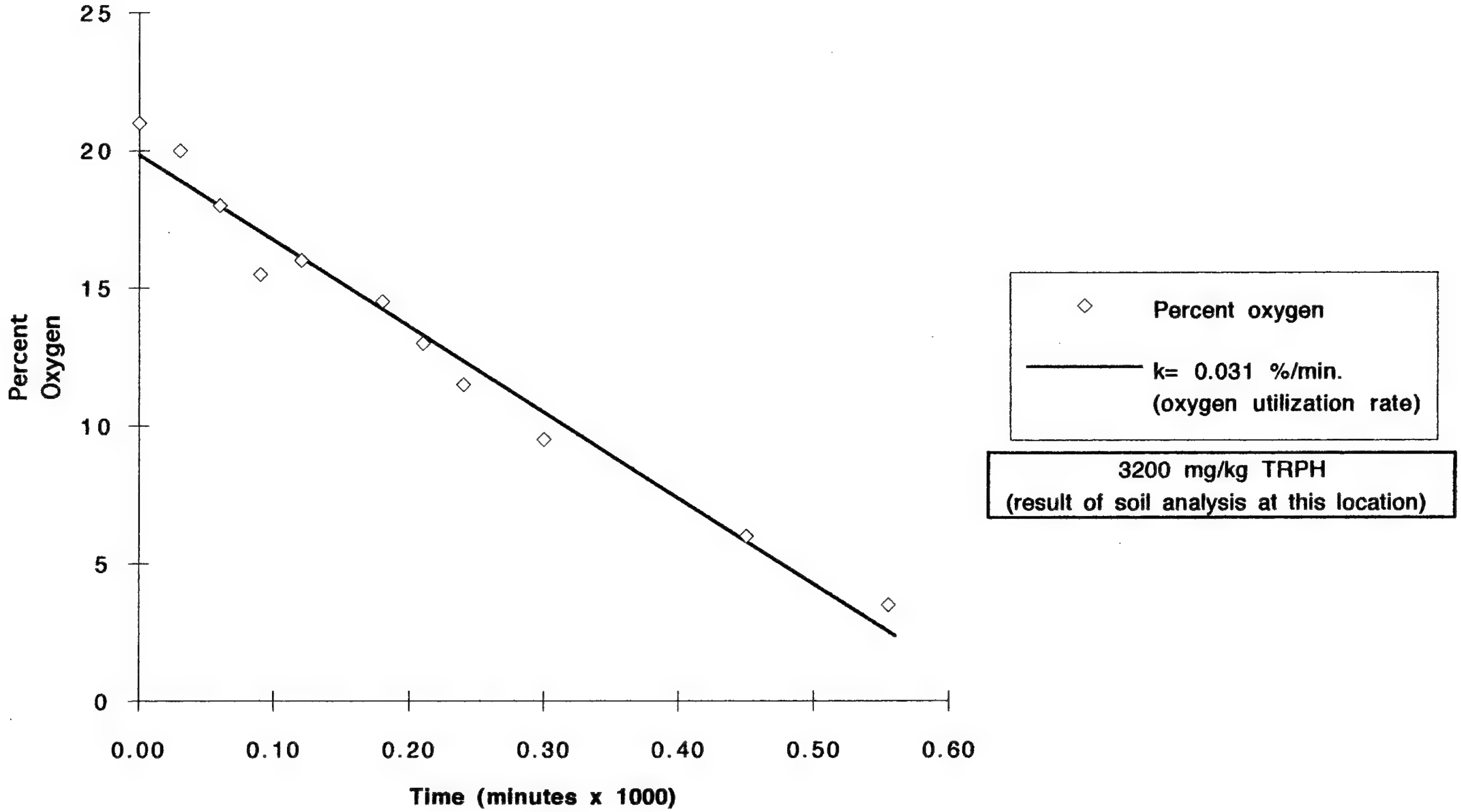


Figure 3.2
Respiration Test
Monitoring Point: BG-6
McGuire AFB, NJ

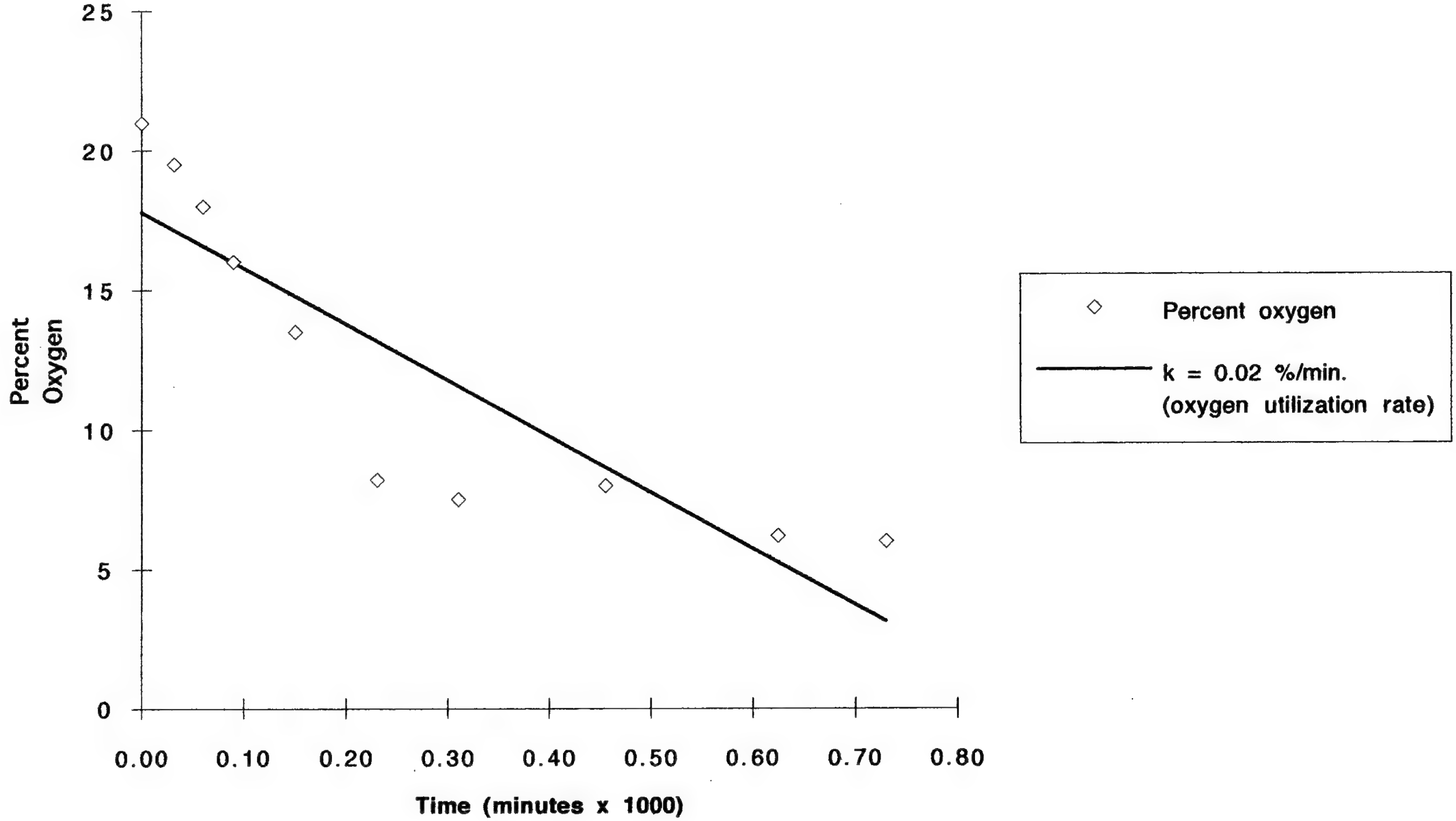


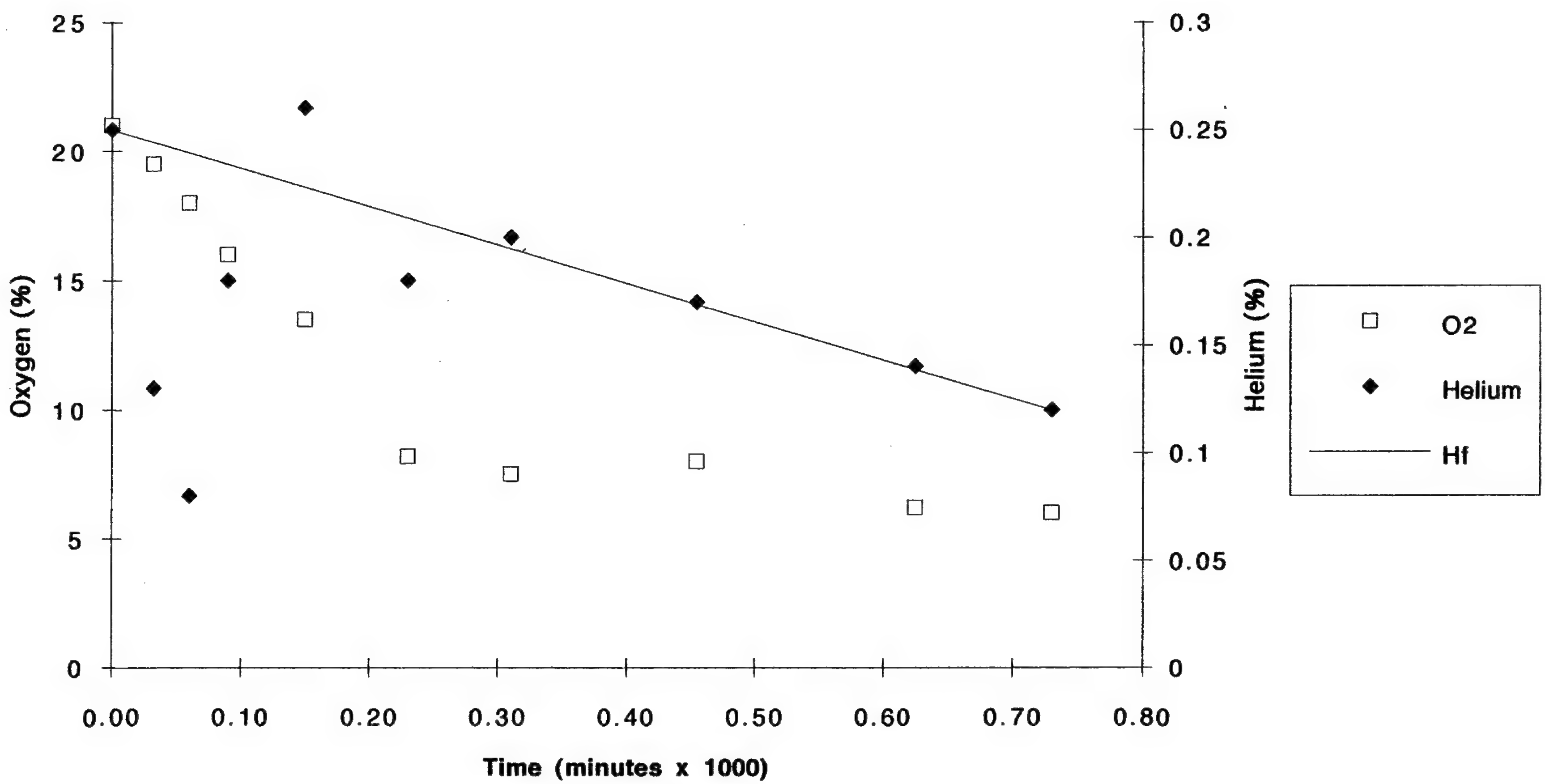
TABLE 3.4

APPARENT AND CORRECTED OXYGEN UTILIZATION RATES
BULK FUEL STORAGE AREA
MCGUIRE AFB, NEW JERSEY

MP	Test Duration (min)	Apparent O_2 loss (%/min)	Fractional Helium Loss (%)	Fractional O_2 Diffusion (%)	Estimated O_2 Diffusion (%/min)	Corrected O_2 Utilization a/ (%/min)
MPA-8	560	0.031	40*	14*	0.005*	0.026
BG-6	730	0.020	52	19	0.005	0.015

* Based on helium diffusion measured at BG-6.
a/ Used to estimate fuel biodegradation rates.

Figure 3.3
Respiration Test
Oxygen and Helium Concentrations
Monitoring Point BG-6
McGuire AFB, NJ



O2/Helium Bkgd

11/19/92

A small, one-horsepower regenerative blower has been installed at the site to continue a rate of air injection of approximately 30 scfm. The one year extended pilot test will begin following regulatory and McGuire AFB review of initial test results. In July 1993, ES will return to the site to sample and analyze the soil gas and conduct a repeat respiration test. A new background MP will also be established at this time. In January 1994, a final respiration test will be conducted, and soil and soil gas samples will be collected from the site to determine the degree of remediation achieved during the first year of *in situ* treatment.

Based on the results of the first year of pilot-scale bioventing, AFCEE will recommend one of two options:

1. Expansion of the bioventing system for full-scale remediation of the site. AFCEE can assist the base in obtaining regulatory approval for upgrading and continued operation.
2. If significant difficulties or poor results are encountered during bioventing at this site, AFCEE may recommend removal of the blower system and proper abandonment of the VW and MPs.

5.0 REFERENCE

Hinchee, R.E., S.K. Ong., R.N. Miller, and D.C. Downey. 1992. *Test Plan and Technical Protocol for a Field Treatability Test for Bioventing.* Prepared for USAF Center for Environmental Excellence. May.

APPENDIX A
GEOLOGIC BORING LOGS
AND
CHAIN-OF-CUSTODY FORMS

ENGINEERING-SCIENCE
DRILLING RECORD

BORING MC-VW

Contractor:
Driller: Mc Ginnis
Inspector: RSM
Rig Type:
Method: 6 1/4" HSA

PROJECT NAME McGuire Air Force Base – Bioventing
PROJECT NUMBER DE268.15

Location:

Weather Clear, 50's
Date/Time Start 10/7/92 1547
Date/Time Finish 10/7/92 1710

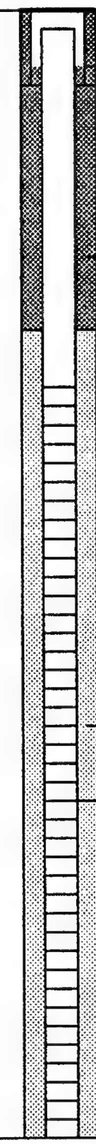
Plot Plan

GROUNDWATER OBSERVATIONS

Water Level				
Date				
Time				
Meas. From				

Photovac Reading	Sample I.D.	Sample Depth	Percent Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL	COMMENTS
		0				
20.3			80	11	Brown sandy soil	curb box / grout 0–1
				15	Coal, gravel fill	
		1				
				17	Green f.–med. sand, hydrocarbon odor, damp	
				14		
		2				
		3				bent. seal
		4				
		5				
61.9	YES		70	22	Grey–green stained f. sand and silt, hydrocarbon odor, damp – dry compact	
				30		
		6				
				25		
				22		
		7				
		8				
		9				sand pack
		10				
			80	5	Light brown f.–med. sand w/ silt, somr grey staining, free product sheen, strong odor, wet	0.040 slot PVC screen
				5		
		11				
				4		
				5		
		12				
		13				
		14				
		15				
		16				
		17				

WELL SCHEMATIC



STANDARD PENETRATION TEST
SS = SPLIT SPOON
A = AUGER CUTTINGS
C = CORED

SUMMARY:

ENGINEERING-SCIENCE DRILLING RECORD

BORING MC-MPA

Contractor:
Driller: Mc Ginnis
Inspector: RSM
Rig Type:
Method: 6 1/4" HSA

PROJECT NAME McGuire Air Force Base - Bioventing
PROJECT NUMBER DE268.15

Location:

Weather Clear, 50's
Date/Time Start 10/8/92 1015
Date/Time Finish 10/8/92 1120

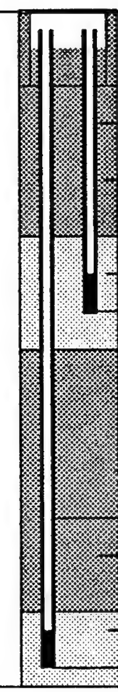
Plot Plan

GROUNDWATER OBSERVATIONS

Water Level				
Date				
Time				
Meas. From				

Photoionizer Reading	Sample I.D.	Sample Depth	Percent Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL	COMMENTS
		0		SS		curb box / grout 0-1
		1				1/2" PVC riser
		2				bent. seal -1-3
		3				
31.2			70	7	Brown-tan f. sand and silt, slight odor, damp	sand -3-4.5
				22		VMP 0.04 slot -3.5-4
		4				
				28		
				23		
		5				
		6				1/2" PVC riser
		7				bent. seal -45.-7.8
1595			80	3	Grey-green f. sand and silt, black staining, damp-moist	
				6		
		8				sand -7.8-9
				16		VMP 0.04 slot -8.25-8.75
				14		
		9				
		10				
		11				
		12				
		13				
		14				
		15				
		16				
		17				

WELL SCHEMATIC



STANDARD PENETRATION TEST
SS = SPLIT SPOON
A = AUGER CUTTINGS
C = CORED

SUMMARY:

ENGINEERING-SCIENCE
DRILLING RECORD

BORING MC-MPB

Contractor:
Driller: Mc Ginnis
Inspector: RSM
Rig Type:
Method: 6 1/4" HSA

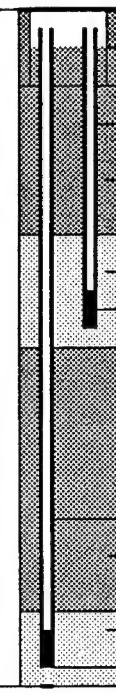
PROJECT NAME McGuire Air Force Base - Bioventing
PROJECT NUMBER DE268.15

Location:

Weather Clear, 50's
Date/Time Start 10/8/92 0805
Date/Time Finish 10/8/92 0915

Plot Plan

GROUNDWATER OBSERVATIONS				
Water Level				
Date				
Time				
Meas. From				

Photoionic Reading	Sample I.D.	Sample Depth	Percent Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL	WELL SCHEMATIC	COMMENTS
		0		SS			curb box / grout 0-1
		1					1/2" PVC riser
		2					bent. seal -1-3
		3					
153			80	11	Tan-grey f. sand and silt, slight odor, damp		sand -3-4.5
				25			VMP 0.04 slot -3.75-4.25
		4					
				32			
				33			
		5					
		6					1/2" PVC riser
		7					bent. seal -45.-7.7
1553	YES		80	4	Grey-green f.-med. sand, black staining, wood chips, strong hydrocarbon odor, damp - moist		
				5			
		8					sand -7.7-9
				5			VMP 0.04 slot -8.25-8.75
				6			
		9					
		10					
		11					
		12					
		13					
		14					
		15					
		16					
		17					

STANDARD PENETRATION TEST
SS = SPLIT SPOON
A = AUGER CUTTINGS
C = CORED

SUMMARY:

ENGINEERING-SCIENCE
DRILLING RECORD

BORING MC-MPC

Contractor:
Driller: Mc Ginnis
Inspector: RSM
Rig Type:
Method: 6 1/4" HSA

PROJECT NAME McGuire Air Force Base - Bioventing
PROJECT NUMBER DE268.15

Location:

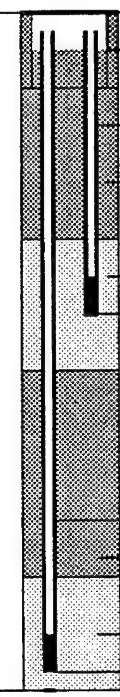
Weather Clear, 50's
Date/Time Start 10/8/92 1503
Date/Time Finish 10/8/92 1600

Plot Plan

GROUNDWATER OBSERVATIONS				
Water Level				
Date				
Time				
Meas. From				

Photometer Reading	Sample I.D.	Sample Depth	Percent Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0		SS	
109			80	4	Yellow-brown/ brown soil, f. sand/silt, no odor, damp-dry
				12	
		1			
				17	
				26	
		2			
87.5			90	30	Grey-green f.-med. sand/silt, no odor, damp
				22	
		3			
				27	
				35	
		4			
233			90	28	Same as above, black staining, strong hydrocarbon odor, damp
				26	
		5			
				20	
				25	
		6			
508			90	12	Same as above, wood chips, damp-moist
				12	
		7			
				12	
				12	
		8			
1797			90	9	Same as above, moist-wet
				9	
		9			
				9	
				9	
		10			
		11			
		12			
		13			
		14			
		15			
		16			
		17			

WELL SCHEMATIC



COMMENTS

- curb box / grout 0-1
- 1/2" PVC riser
- bent. seal -1-3
- sand -3-4.5
- VMP 0.04 slot -3.5-4
- 1/2" PVC riser
- bent. seal -45.-7.5
- sand -7.5-9
- 0.04 slot -8.5-9

STANDARD PENETRATION TEST
SS = SPLIT SPOON
A = AUGER CUTTINGS
C = CORED

SUMMARY:

ENGINEERING–SCIENCE
DRILLING RECORD

BORING MC–BG

Contractor:
Driller: Mc Ginnis
Inspector: RSM
Rig Type:
Method: 6 1/4" HSA

PROJECT NAME McGuire Air Force Base – Bioventing

PROJECT NUMBER DE268.15

Location:

Weather Clear, 50's

Date/Time Start 10/7/92 0855

Date/Time Finish 10/7/92 1425

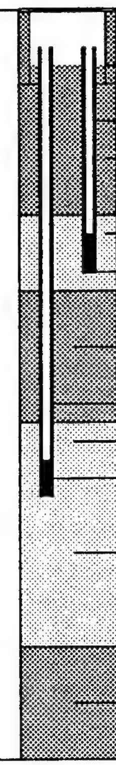
Plot Plan

GROUNDWATER OBSERVATIONS

Water Level				
Date				
Time				
Meas. From				

Photoionization Reading	Sample I.D.	Sample Depth	Percent Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL	COMMENTS
		0		SS		
0			50	3	Brown f. sand, silt, pebbles, no odor, moist	curb box / grout 0–1
				5		
		1				
				5		1/2" PVC riser
				6		bent. seal –1–2.6
		2				
0			70	7	Same as above, no odor, moist – wet	
				5		#3 sand –2.8–3.75
		3				
				4		VMP 0.04 slot –3–3.5
				5		
		4				
11.5			80	4	Same as above	bent. seal –3.75–5.4
				3	Black stained organic material: peat w/ sand and slt, musty odor, wet – moist	
		5				1/2" PVC riser
				3		
						#3 sand –5.4–6.5
				3		
		6				VMP 0.04 slot –6–6.5
51.7			80	2	Same as above	
				3		
		7				#3 sand –6.5–8.5
				4	Fine sand	
					Black stained organic material: peat w/ sand and slt, musty odor, wet – moist	
				4		
		8				
11.5			100	3	Same as above	
				5		
		9				hole plug –8.5–10
				6		
				15	Brown – tan fine to coarse sand, no odor, moist – wet	
		10				
9.5			80	16	Same as above, tan – grey	
				21		
		11				
				21	Tan fine gravel	
				23		
		12				
		13				
		14				
		15				
		16				
		17				

WELL SCHEMATIC



STANDARD PENETRATION TEST
SS = SPLIT SPOON
A = AUGER CUTTINGS
C = CORED

SUMMARY:

AIR TOXICS LTD.
AN ENVIRONMENTAL ANALYTICAL LABORATORY

11325 SUNRISE GOLD CIRCLE, SUITE 'E'
RANCHO CORDOVA, CA 95742
(916) 638-9892 • FAX (916) 638-9917

CHAIN OF CUSTODY RECORD

PROJECT # DE 268.15.04 PO # DE 268.15.04 COLLECTED BY (Signature) David A Brown

REMARKS Collected by Engineering-Science for McGuire AFB Bioventing Test

	FIELD SAMPLE I.D.#	SAMPLING MEDIA (Tenax, Canister etc.)	DATE/TIME	ANALYSIS	VAC./PRESSURE	LAB I.D. #
01A	MC-VW	Soil Gas	10/16/92 0745	BTEX, TVH	1.0" Hg	
02A	MC-MPA-9	Soil Gas	10/16/92 0745	BTEX, TVH	1.0" Hg	

RELINQUISHED BY: DATE/TIME	RECEIVED BY: DATE/TIME	RELINQUISHED BY: DATE/TIME	RECEIVED BY: DATE/TIME
David A Brown 10/16/92 1220	Federal Express 10/16/92 1220		[illegible]

Air bill No 8620524555

10/17/92 11:00

LAB USE ONLY

SHIPPER NAME	AIR BILL #	OPENED BY: DATE/TIME	TEMP(°C)	CONDITION

REMARKS

Figure

CHAIN OF CUSTODY RECORD

...NEERING-SCIENCE, INC.
... BROADWAY, SUITE 900
DENVER, COLORADO 80290
303-831-8100

ES Job No.
DE268. 1 5 .08

AFCEE BIOVENTING PILOT TESTS

Base: McGuire AFB

Site: #1

Sampler(s): (Signature) Ronald S. Moran

Preservative: NONE (SW 9045, A 403, SW 7380, SW 846); HOLD AT 4C (SW 8020, E 418.1); NONE (E 351.2, E 365.3, UCM)

Analysis Required

Date	Time	Sample Description	Lab I.D.	No. of Contrs.	SW 9045 (PH)	A 403 (ALKA)	SW 7380 (IRON)	SW 846 (MOIST)	SW 8020 (BTEX)	E 418.1 (TRPH)	E 351.2 (TKN)	E 365.3 (PHOS)	UCM (CLASS)	Sample Type	Matrix	Remarks
10/7/92	1355	MC-VW-7	Berk	1	X	X	X	X						G C	SOIL	
''	''	'' '' ''	Berk	1					X	X				G C	SOIL	
''	''	'' '' ''	SeQ	1							X	X	X	G C	SOIL	
10/8/92	0820	MC-MPB-9	Berk	1	X	X	X	X						G C	SOIL	
''	''	MC-MPB-9	Berk	1					X	X				G C	SOIL	
''	''	'' '' ''	SeQ	1							X	X	X	G C	SOIL	
10/8/92	1030	MC-MPA-9	Berk	1	X	X	X	X						G C	SOIL	
''	''	'' '' ''	Berk	1					X	X				G C	SOIL	
''	''	'' '' ''	SeQ	1							X	X	X	G C	SOIL	
														G C	SOIL	
														G C	SOIL	
														G C	SOIL	
														G C	SOIL	
														G C	SOIL	
														G C	SOIL	
														G C	SOIL	

Ship To:

ENGINEERING-SCIENCE LABORATORY
600 Bancroft Way
Berkeley, CA 94710

Attn: Tom Paulson
(510) 841-7353

Relinquished by: (Signature)	Date / Time	Recieved for Laboratory by: (Signature)	Date / Time
Ronald S. Moran	10/8/92 / 1430		
Relinquished by: (Signature)	Date / Time	Recieved for Laboratory by: (Signature)	Date / Time

Remarks:

G - Grab Sample, C - Composite Sample

Distribution: Original Accompanies Shipment. Copies to: Coordinator Field Files

Federal Express Number: 1211-2510-2

Airbill Number: 492 1945210

ENGINEERING-SCIENCE, INC.
1700 Broadway, Suite 900 • Denver, Colorado
(303) 831-8100

CCRSOIL

C-OF-C NUMBER 1 OF 1

ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD FOR WATER SAMPLES

ES JOB NO.

PROJECT NAME/LOCATION: 4451.

FIELD CONTACT:

SAMPLERS NAMES & SIGNATURES

PRESERVATIVES REQUIRED

ANALYSES REQUIRED

DATE	TIME	FIELD SAMPLE IDENTIFIER	E351.2 (TKN)	E365.3 (PHOS) T	UCM (CLASS)		REMARKS
10/7/92	1355	MC - VW-7 (4451.01C)	✓	✓	✓	210 17 ~~58~~ 57	REPORT RESULT ON DRY SOIL
10/8/92	0820	MC-MPB-9 (4451.02C)	✓	✓	✓	~~59~~ 58	BASIS. USE MDL'S FOR
10/8/92	10:30	MC-MPA-9 (4451.03C	✓	✓	✓	~~60~~ 59	REPORTING UNITS.
							REPORT METHOD BLANKS
							MS/MSD (10 DAY REPORT
							TAT). REPORT RESULTS
							TO: TOM PAULSON ES3(

TO: SEQUOIA LAB

FIELD CUSTODY RELINQUISHED BY: [signature] DATE: 10/13/92 TIME: 1155

SHIPPED VIA: AIRBILL #

ON RECEIPT: CUSTODY SEALS? ______; TEMP: ______ °C

RECEIVED FOR LABORATORY BY: [signature] DATE: 10/13/92 TIME: 11:55 AM

APPENDIX B

O & M CHECKLIST

SYSTEM MAINTENANCE

B.1 BLOWER/MOTOR MAINTENANCE

The blower and motor are relatively maintenance free. There is no lubrication required because the blower and motor have sealed bearings. If a blower system is in need of repair, please contact Dave Brown at (315) 451-9560.

B.2 FILTER MAINTENANCE

To avoid damage caused by passing solids through the blower, an air filter has been installed inline before the blower. By design, Gast® regenerative blowers are able to ingest small quantities of particles without damage. However, continuous ingestion of solids will damage or imbalance the impellers. The inline air filter will prevent solids from entering the blower, and is rated at 99 percent efficiency to 10 microns.

The filter element is a polyester cloth and can be cleaned and reused, or replaced. The filter should be checked weekly for the first 2 months of operation. The air filter should be cleaned or replaced when the pressure difference across the filter reaches 15 to 20 inches of water. It is the responsibility of McGuire AFB to determine the best schedule for filter cleaning and/or replacement, depending on the results of the initial observations.

The filter can be checked after turning off the blower system. To remove the filter, loosen the clamps, lift the metal top off the air filter, and lift the air filter from the metal housing. When replacing the filter, be careful that the rubber seals remain in place. The filter is manufactured by Solberg Manufacturing, Inc. in Itasca, Illinois. Their phone number is (708) 773-1363. The filters can also be obtained through Fluid Technology, Inc. in Denver, Colorado. The contacts there are Mr. Bob Cook and Mr. Greg Sparks; they can be reached at (303) 233-7400. It is recommended that McGuire AFB keep a spare air filter at the site.

B.3 BLOWER PERFORMANCE MONITORING

To monitor the blower performance, vacuum, pressure, and temperature will be measured. These data will be recorded on the data collection sheets provided. All measurements will be taken at the same time while the system is running.

B.3.1 Pressure/Vacuum

Open the shed roof and record the pressure and vacuum readings directly from the gages in inches of water. Record the measurements on the data collection sheet

provided.

B.3.2 Temperature

Open the shed roof and record the temperature readings directly from the gages in degrees Fahrenheit. Record the measurements on the data collection sheet provided.

B.4 MONITORING SCHEDULE

The following monitoring schedule is recommended for this system. During the initial months of operation, more frequent monitoring is recommended to ensure that any start up problems are quickly corrected. Data collection sheets have been provided to record the system data.

Monitoring Item	Monitoring Frequency
Blower vacuum and temperature	Weekly for the first 2 months of operation. McGuire AFB personnel then may optimize the schedule depending on the results of initial observations.

BLOWER INJECTION SYSTEM DATA COLLECTION SHEET

SITE:________

DATE	TIME	INLET VACUUM (IN. WATER)	OUTLET TEMP. (DEGREES F)	OUTLET PRESSURE (IN. WATER)	FILTER CHANGED (Y or N)	BLOWER FUNCTIONING UPON ARRIVAL (Y or N)	COMMENTS	CHECKED BY